

ORIGINAL

UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

vs.

U.S. ARMY CORPS OF ENGINEERS,

Respondent,

and,

PETROLEUM ASSOCIATION OF WYOMING,

Intervenor.

Case No. 02-CV-155-D

EXHIBITS IN SUPPORT OF
PETITION FOR REVIEW OF
AGENCY ACTION

Petitioners submit the following List of Exhibits and the Attached Excerpts of Exhibits in support of their Petition for Review of Agency Action.

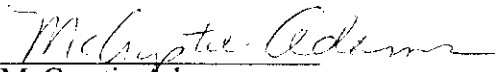
<u>Exhibit</u>	<u>Title</u>
1.	BLM's Powder River Basin Oil & Gas Project, Final Environmental Impact Statement, January 2003 (excerpts)
2.	Laurel McCoul GP 98-08 Comment Letter, May 14, 1999 (A.R. 335-338)
3.	Robert & Nancy Sorenson GP 98-08 Comment Letter, Feb. 13, 2000 (A.R. 415-417)
4.	EPA GP 98-08 Comment Letter, March 30, 1999 (A.R. 216-219)
5.	General Permit 98-08, June 20, 2000 (A.R. 570-578A)
6.	Combined Decision Document, June 20, 2000 (A.R. 510-548)
7.	Corps' Talking Points, March 3, 1999 (A.R. 204-05)
8.	Corps First Public Notice, Draft GP 98-08, March 3, 1999 (A.R. 195-203)
9.	Corps Second Public Notice, Draft GP 98-08, April 15, 1999 (A.R. 271-280)
10.	EPA GP 98-08 Comment Letter, May 10, 1999 (A.R. 298-99)

11. US Fish and Wildlife Service GP 98-08 Comment Letter, May 14, 1999 (A.R. 367-71)
12. Wyoming Game & Fish Department GP 98-08 Comment Letter, May 14, 1999 (A.R. 363-64)
13. Wyoming Outdoor Council GP 98-08 Comment Letter, March 31, 1999 (A.R. 220-32)
14. Biodiversity Conservation Alliance Letter, May 14, 1999 (A.R. 341-58)
15. Corps Letter to BLM Re: GP 98-08, July 6, 2000
16. National Research Council, Compensating for Wetland Losses under the CWA, 2001
17. National Research Council, Restoration of Aquatic Ecosystems, 1992 (excerpts)
18. Race & Fonseca, Fixing Compensatory Mitigation, 1996
19. Zedler, Ecological Issues in Wetland Mitigation, 1996
20. US Fish & Wildlife Service, Wetland Losses in Northern California from Projects Authorized under Nationwide Permit 26, October 1992 (excerpts)
21. EPA Comment Letter to BLM re: Powder River Basin DEIS, May 15, 2002
22. Wyoming Dept. of Environmental Quality, Whole Effluent Toxicity (West) Testing of Coalbed Methane (CBM) Produced Water in Northeastern Wyoming, October 30, 2003
23. Transcript of Hearing on Motion for Preliminary Injunction, February 3 & 4, 2004 (excerpts)
24. Montana Dept. of Environmental Quality Letter to Wyoming on Water Quality Issues, January 2, 2001
25. Montana and Wyoming Powder River Interim Water Quality Criteria Memorandum of Cooperation, Appendix C, September 2001
26. JM Huber Corp., Water Management Plan, March 2003
27. Wyodak Coal Bed Methane Project Final Environmental Impact Statement, October 1999 (excerpts)
28. U.S. Army Corps of Engineers and Wyoming Department of Environmental Quality Proposed General Permit, March 2004

29. Declaration of Bernadette Barlow and exhibits, December 18, 2003
30. Declaration of Ed Swartz and exhibits, December 19, 2001
31. Declaration of Jill Morrison and exhibits, January 2, 2004
32. Declaration of Erik Molvar, December 2, 2003
33. Declaration of Dr. Larry Munn and exhibits, March 16, 2004
34. Declaration of James Gore and exhibits, December 18, 2003
35. Wyoming Department of Environmental Quality Investigative Report – Barlow Ranch, August 11, 2003
36. West Nile Virus Wyoming Cumulative Human Map, February 2, 2004
37. U.S. Army Corps of Engineers Information on West Nile Virus, March 18, 2004
38. BLM Buffalo Field Office Environmental Assessment for Pennaco Energy, Inc. House Creek 10 Plan of Development,

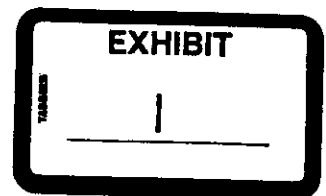
Respectfully submitted,

Dated: July 8, 2004


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Earthjustice

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Wyoming Outdoor Council

Attorneys for Petitioners





U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office

Buffalo Field Office

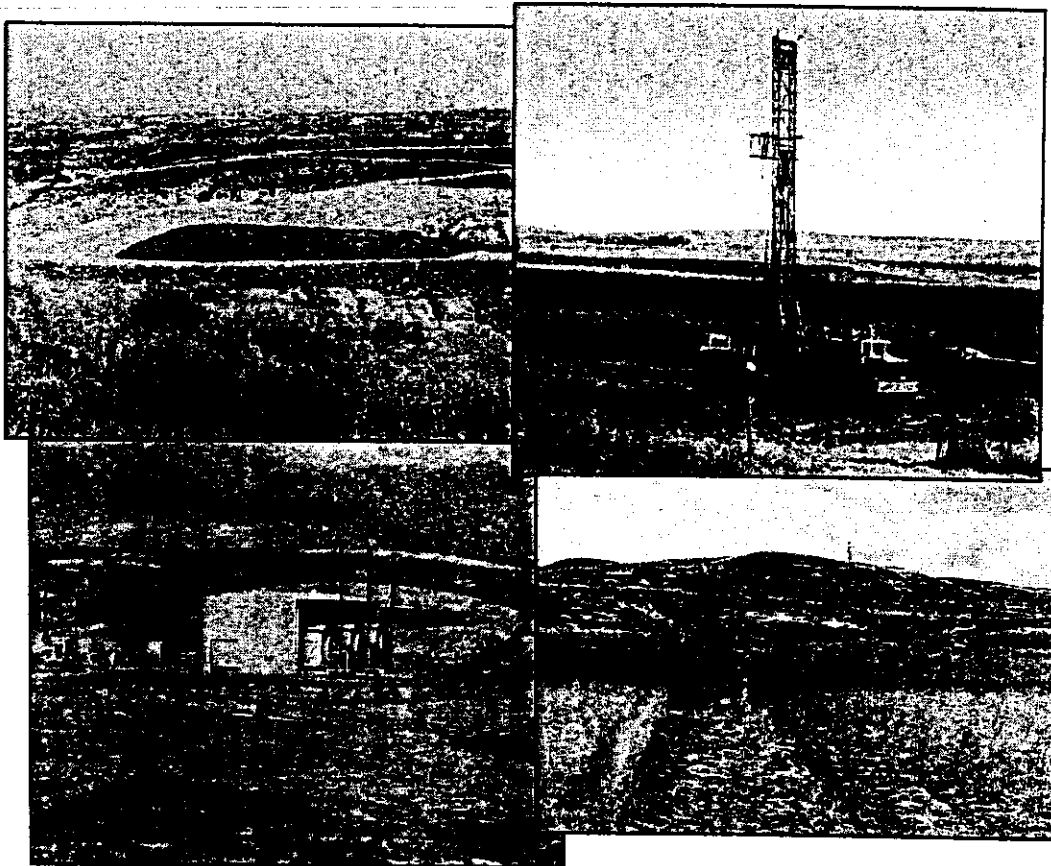
January 2003



Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project

Volume 1 of 4

(WY-070-02-065)



Chapter 1 — Purpose and Need

A group of oil and gas companies (Lance Oil and Gas [Western Gas Company], Barrett Resources Corporation [Williams], Devon Energy Corporation, Yates Petroleum Corporation, Pennaco Energy [Marathon Oil Corporation], and CMS Oil and Gas [Perenco S.A]), collectively identified as the Powder River Basin Companies (Companies), has notified the U.S. Department of Interior, Bureau of Land Management (BLM) and U.S. Department of Agriculture, Forest Service (FS) of their intent to develop additional coal bed methane (CBM) resources in Wyoming's Powder River Basin (PRB). Implementation of this project would continue and expand development of CBM that has been occurring in the PRB over the last few years. In general, the Companies propose to:

- Drill, complete, operate, and reclaim almost 39,400 new natural gas wells and
- Construct, operate, and reclaim various ancillary facilities needed to support the new wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors.

The proposed project would occur in a Project Area of almost 8 million acres (Figure 1-1). This Project Area encompasses all or parts of Campbell, Converse, Johnson, and Sheridan counties and all or parts of 18 fourth-order watersheds (sub-watersheds). The proposed project would involve both public and privately owned lands. The public lands include areas administered by the BLM, the Medicine Bow National Forest, and the state. Additional information on land ownership and jurisdiction is presented in Chapter 3.

Development of Oil and Gas on Federal Lands in the Powder River Basin

Development of oil and gas in the PRB is generally classified into two categories: CBM and non-CBM. Development of CBM resources began in the mid-1980s. With advancements in technology, development and production of CBM has been increasing substantially since the mid-1990s. In contrast, production of non-CBM resources was relatively stable from 1986 through 1991, but has been declining sharply since (BLM 2001f). Overall, oil and gas development in the PRB, exclusive of CBM, is expected to decline slowly (BLM 2001f).

Five sets of documents provide the primary guidance on development of oil and natural gas from federal lands and minerals estates in the Project Area. Two sets of these documents are the resource management plans (BLM 1985b and BLM 2001a), Final Environmental Impact Statements (FEISs), and Records of Decision (RODs) for the Buffalo and Casper Field Offices. The other three sets of documents provide the primary guidance for the Thunder Basin National Grassland (TBNG), which is administered by the Medicine Bow National Forest. These sets are the 1985 Land and Resource Management Plan (LRMP), FEIS,

Coal Bed Methane Development

Under this alternative, the Companies would drill, complete, and operate 39,367 new CBM wells within the Project Area over a 10-year period (Table 2-1). Including the 12,024 CBM wells already drilled or permitted for drilling in the Project Area, the Companies would drill, complete, and operate 51,391 CBM wells by the end of 2011 (Figure 2-1 and Table 2-2).

The Companies also would construct the ancillary facilities needed to support these wells. The ancillary facilities include access roads; pipelines for gathering gas and produced water; electrical utilities; facilities for measuring and compressing gas; facilities for treating, discharging, disposing of, containing, or injecting produced water; and pipelines to transport gas to high-pressure transmission pipelines. These transmission pipelines would deliver the gas to market.

The overall life of the Proposed Action, including drilling, production, and reclamation, is expected to be about 20 years. Construction of the 39,367 new wells would begin during 2002. The Companies would drill these wells over a 10-year period (Table 2-1). The productive life of each well is expected to be about 7 years. Accordingly, production from at least some of the 39,367 new wells is expected to last until 2018 (because the first year of production was assumed to be the year the wells are drilled, a well drilled in 2011 would complete 7 years of production at the end of 2017). Final reclamation of these wells would occur during the 2 to 3 years after production ends. Thus, the Proposed Action would be completed around the end of 2020. As a result of the proposed schedule for drilling wells and the 7-year productive life, the cumulative number of wells producing CBM would increase rapidly over 5 years, peak at more than 35,000 during 2007, and steadily decline through 2017 (Figure 2-2).

Because of comments received on the draft, a review of average productive well life was conducted to see if estimates of well life used in the DEIS needed to be adjusted. To obtain an average well life, 264 CBM wells east of the Powder River were selected by searching the PL/Dwights database for wells with first production dates of December 31, 1996 or earlier. Of the 264 wells, 216 had enough data to calculate a well life and an estimated ultimate gas recovery (EUR). The other 58 wells were shut-in. The estimated average well life for the 216 wells was 8.5 years. Data also suggested average well lives of between 3 to 5 years. These wells are in areas where wells have already been drilled and now new wells are being drilled to in-fill between existing wells.

This same process was used to look at the history of wells on the west side of the PRB. Because of limited history, only 25 wells had data sufficient for estimating production life. The average production life for these wells was 4.3 years and the maximum was 8.25 years. This sample may not be representative of future conditions because of the limited number of wells involved.

Upon review, it was determined that the difference in average production life for the wells considered in the analysis was not sufficient to warrant changing the 7-year well life assumption used in the DEIS.

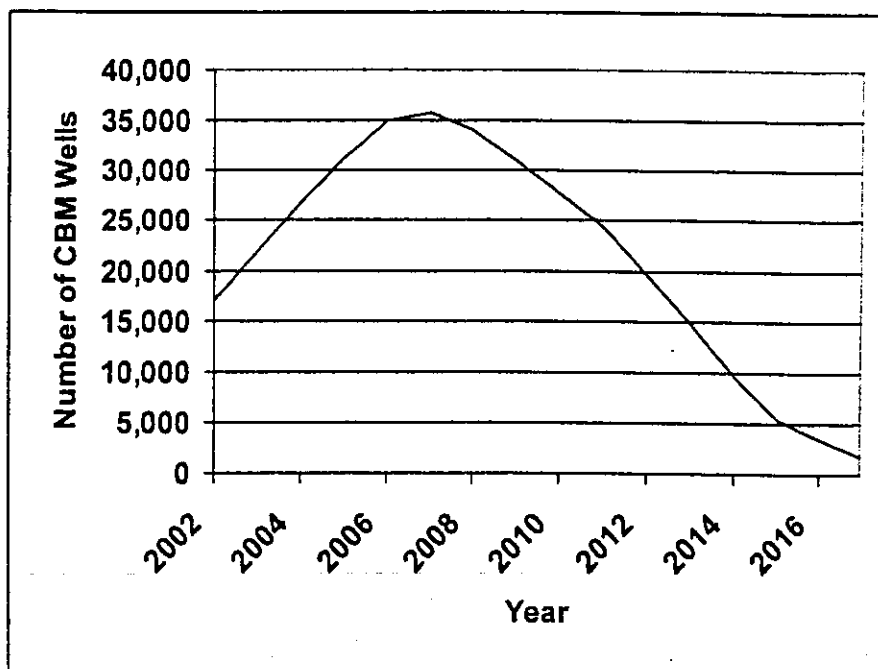


Figure 2-2 Cumulative Number of Producing CBM Wells Over the Productive Life of the Project

Several coal beds occur together in parts of the Project Area. Standard practice in these areas is to drill a separate well to develop each coal bed. Where possible, the Companies would collocate these wells on the same well pad. Based on this practice of collocation and knowledge of the locations of multiple coal beds likely to produce CBM, BLM and the Companies project the 39,367 new wells would be drilled from almost 26,000 well pads (Table 2-3). The total number of wells and well pads is based on an 80-acre spacing pattern overall (eight pads per square mile). Including the pads constructed for wells drilled before 2002, the 51,391 CBM wells would be distributed across almost 35,600 well pads (Table 2-4 and Figure 2-1). For this NEPA analysis, the number of wells on a pad was assumed to range from one to three. However, BLM recognizes the Companies are trying to develop the technology for multiple coal seam completions and encourages these efforts and its potential to reduce the number of wells drilled.

Under the Proposed Action, the Companies would drill, operate, and maintain wells and construct ancillary facilities in 10 of the 18 sub-watersheds that constitute the Project Area (Table 2-5). However, most of the new wells (63 percent) and facilities would be constructed in two sub-watersheds: the Upper Powder River and Upper Belle Fourche River. Other sub-watersheds with relatively high numbers of wells and facilities include Clear Creek, Crazy Woman Creek, Upper Tongue River, and Little Powder River.

Overall, implementation of the CBM portion of the Proposed Action could disturb as many as 193,589 surface acres, most associated with the construction of pipelines, roads, and water handling facilities (Table 2-6). Compressor stations would account for the smallest amount of the overall surface disturbance. Short-term disturbance would encompass about 3 percent of the Project Area.

Table 2-8 Projected Amount of Water Produced from CBM Wells Under Alternatives 1, 2A, and 2B

Sub-watershed	Water Produced (in acre-feet) ¹																Total
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Little Bighorn River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Tongue River	11,019	16,950	20,272	22,133	22,351	19,945	20,282	15,782	15,782	15,654	8,646	4,721	2,522	1,290	601	214	198,164
Middle Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Powder River	100,512	137,942	159,034	167,608	171,423	163,521	147,481	88,046	60,319	44,169	23,697	12,169	5,672	2,242	1,032	366	1,285,233
South Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt Creek	263	306	356	358	412	232	131	69	36	17	7	0	0	0	0	0	2,187
Crazy Woman Creek	9,449	15,185	18,418	20,240	21,135	21,036	20,279	15,962	13,716	12,240	6,731	3,629	1,881	910	422	150	181,383
Clear Creek	10,697	18,192	22,415	24,795	26,267	25,997	24,879	22,762	22,071	21,576	11,969	6,552	3,500	1,780	832	299	244,583
Middle Powder River	8,257	10,421	11,640	12,328	12,044	9,897	9,689	6,030	6,030	5,899	3,276	1,797	964	495	231	82	99,080
Little Powder River	18,613	20,822	21,832	22,427	21,330	18,607	19,121	8,016	7,124	6,439	3,930	2,340	1,335	699	350	133	173,118
Little Missouri River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antelope Creek	15,460	17,271	17,685	17,503	17,385	16,180	12,613	5,226	3,574	2,956	1,041	363	124	40	13	3	127,437
Dry Fork Cheyenne River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Cheyenne River	7,978	8,421	8,365	8,275	8,228	7,002	5,897	2,144	1,456	1,013	357	125	43	14	4	1	59,323
Lightning Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Belle Fourche River	54,735	67,481	76,259	82,713	85,761	84,507	79,493	49,435	39,170	31,277	21,215	13,495	7,630	3,347	1,849	790	699,157
Middle North Platte River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	236,983	312,991	356,276	378,380	386,336	366,924	339,865	213,472	169,278	143,251	80,869	45,191	23,671	10,817	5,334	2,038	3,069,665

Note:

i. Volumes shown include produced water from pre-2002 wells as well as the new CBM wells.
 Sources: BLM 2001e and Meyer 2002b.

Surface gauging stations may be needed on the Little Powder, Powder, Belle Fourche, Cheyenne, and Tongue Rivers. The cost of this monitoring would be shared among BLM, the U.S. Department of the Interior, Geological Survey (USGS), and the Companies.

BLM would periodically monitor water quality by sampling at discharge points and on streams. BLM also would monitor selected stream channels that receive CBM discharged water for signs of accelerated erosion and degradation.

In August 2001, the States of Montana and Wyoming signed an Interim MOC to document their commitments and intent to protect and maintain water quality in the PRB within Montana during an 18-month interim period (Appendix B). At the conclusion of this interim period, the states will negotiate a final MOC that will include recognition of protective water quality standards and allocation of any assimilative capacity. A monitoring program to implement the interim MOC and to assist in development of a final MOC is part of the agreement. Currently, the states are developing this monitoring program. Once it has been developed, the aspects of the monitoring plan that are applicable to the oil and gas development addressed in this EIS would be incorporated into the ROD.

Alternative 2 — Proposed Action with Reduced Emission Levels and Expanded Produced Water Handling Scenarios

Alternative 2 was developed specifically to respond to four of the 18 key issues. They are the issues addressing effects of the Proposed Action on aquifers (Issue 1), the quantity and quality of surface waters (Issues 2 and 3), and effects on air quality and visibility (Issue 6). BLM and FS altered the Proposed Action in two primary areas to respond to these issues: handling of produced water and compression of gas. Other than the differences described below, Alternative 2 is the same as the Proposed Action.

Methods for Handling Produced Water

The overall methods for handling the disposal of produced water are the same as were included in the Proposed Action. However, BLM and FS have altered the distribution of produced water among the methods to emphasize handling in two ways: infiltration and treatment. As shown on Table 2-21, Alternative 2A emphasizes use of infiltration impoundments to dispose of CMB produced water. In contrast, Alternative 2B emphasizes the use of passive and active treatment to dispose of CBM produced water (Table 2-22). The emphasis of these alternatives was developed in response to WDEQ's projections for how CBM produced water probably would be handled in the future to meet the MOC between Montana and Wyoming on Interim Water Quality Criteria (Appendix B).

The changes in methods of water handling included as part of Alternatives 2A and 2B slightly alter the number of acres that would be disturbed. Instead of affecting 193,589 acres of short-term disturbance as under Alternative 1, Alternative 2A would affect 202,843 acres over the short term (Table 2-23). Long-term disturbance associated with Alternative 2A also would be slightly less, at

Chapter 2 — Public Participation, Issue Identification, and Alternatives

95,138 acres (Table 2-24). In contrast, Alternative 2B would affect 199,233 acres over the short term (Table 2-25) and 91,528 acres over the long term (Table 2-26).

Table 2-21 Assumed Water Handling Methods for CBM Wells with an Infiltration Emphasis — Alternative 2A

Sub-watershed	Water Handling Method ^{1,2,3}						
	NPDES-permitted Discharge					LAD (percent)	Injection (percent)
	Untreated Discharge (percent)	Passive Treatment (percent)	Active Treatment (percent)	Infiltration Impoundment (percent)	Containment Impoundment (percent)		
Upper Tongue River	0	5	0	65	5	15	10
Upper Powder River	0	30	0	60	0	5	5
Salt Creek	0	0	0	70	5	5	20
Crazy Woman Creek	0	5	0	70	5	10	10
Clear Creek	0	5	0	70	5	10	10
Middle Powder River	0	30	0	55	0	10	5
Little Powder River	0	40	0	45	0	10	5
Antelope Creek	0	60	0	30	0	5	5
Upper Cheyenne River	0	60	0	30	0	5	5
Upper Belle Fourche River	30	30	0	30	0	5	5

Notes:

1. The percentages shown represent the distribution of water handling methods assumed for the analysis, not the amount of water that actually reaches the river.

2. Handling Methods:

NPDES-permitted Discharge – includes methods of handling the produced water that require an NPDES permit.

Untreated discharge – water that is discharged onto the surface of the ground without any treatment.

Passive treatment – water that is amended through passive methods to meet standards before discharge. An example of this method is passing the water over scoria to remove iron.

Active treatment – water that is amended through active methods to meet standards before discharge. An example of this method is passing the water through a reverse osmosis system.

Infiltration impoundment – water contained in upland and bottomland impoundments allowing for infiltration and groundwater recharge. Infiltration impoundments constructed in-channel may allow for overflow under given storm events.

Containment impoundment – includes upland impoundments, lined, with minimal infiltration and no direct surface discharge or lateral subsurface movement of water and down-gradient expression in seeps or springs. These impoundments are permitted by WOGCC.

LAD = land application disposal. Typically, land application is achieved by spraying produced water through agricultural irrigation equipment and high-pressure atomizers.

Injection – represents that water that is injected into disposal wells.

3. The above percentages are not upper thresholds that can or will be enforced. They are merely a disclosure of effects of one of many various ways water may be handled to meet the Wyoming water quality standards and agreement with bordering states.

Compression

This alternative includes two options for compression of the CBM, both of which were analyzed in detail. The first option is electrification of 50 percent of the booster compressors. Under this option, half of the new 1,060 booster compressor units would be electrically powered. The other half would be gas-fired units. The power for the electrical units would be brought to the compressor stations via the same power lines that are included in the Proposed Action. Thus, no new external construction would be required. Except for the exchange of gas-fired booster units for electrical booster units, no other visible changes would occur. Reciprocating compressors would remain the same.

Table 2-23 Summary of Estimated Short-term CBM Disturbance Associated with Alternative 2A

Sub-watershed	Well Pads (acres)	CMF's (acres)	Roads			Poly Pipeline		Water Handling Facilities ¹		Compressor Discharge Pipelines		Power Line Overhead		Compressor Stations		Total ⁴ (acres)
			Improved (acres)	Two-track (acres)	2-3-inch (acres)	12-inch (acres)	(acres)	(acres)	(acres)	Booster ² (acres)	Recip. (acres)	(acres)	(acres)	Recip. (acres)	Booster (acres)	
Little Big Horn River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Tongue River	631	59	1,542	520	2,075	782	3,133	0	0	727	248	782	0	10	12	10,521
Middle Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Powder River	4,978	435	11,635	3,639	14,529	5,458	17,165	2,408	6,327	0	0	5,458	0	175	232	72,439
South Fork Powder River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt Creek	11	1	234	88	350	132	46	24	121	0	0	132	0	5	4	1,148
Crazy Woman Creek	773	67	2,374	824	3,288	1,234	3,460	364	1,187	0	0	1,234	0	25	24	14,854
Clear Creek	1,010	86	2,363	908	3,623	1,362	4,447	320	778	0	0	1,362	0	10	18	16,287
Middle Powder River	238	22	682	188	752	283	891	206	267	0	0	283	0	5	6	3,823
Little Powder River	534	47	2,548	1,058	4,222	1,586	1,730	327	485	0	0	1,586	0	15	12	14,150
Little Missouri River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antelope Creek	474	38	7,703	3,683	14,694	5,524	1,093	191	417	0	0	5,524	0	20	14	39,375
Dry Fork Cheyenne River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Cheyenne River	160	12	812	166	662	249	354	291	455	0	0	249	0	10	6	3,426
Lightning Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Upper Belle Fourche River	1,664	136	4,701	1,798	7,176	2,702	3,944	473	1,455	0	0	2,702	0	30	40	26,820
Middle North Platte River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ³	10,474	903	34,593	12,871	51,372	19,312	36,263	4,852	12,217	0	0	19,312	0	305	368	202,843

Notes:

1. Disturbance includes the areal extent of direct discharge facilities, containment reservoirs, land application facilities, and injection wells. The ratios of water handling facilities applied to each sub-watershed are shown on Table 2-21.
2. Reciprocating (Recip.) compressors increase the compression of natural gas for delivery to high-compression transmission pipelines. Each station would consist of one to six recip compressors, depending on the volume of gas being delivered to the station.
3. Booster compressors enhance the flow of gas from the wells to the recip compressors. Each station would consist of one to six booster compressors, depending on the volume of gas delivered to the station.
4. Total may not match precisely with the value obtained by adding unit numbers because of rounding conventions.

Source: BLM 2001e

Table 2-27 Estimated CBM Employment Requirements for Alternative 2A

Work Category	Time Requirements per Unit	Number of Units	Peak Number of Workers per Year ¹
<i>Construction and Installation</i>			
Access Roads	0.5 day/mile	7,163	16
Well Pads	1 day/pad	25,997	8
Pipelines	2 days/mile	20,846	97
Electrical Utility Lines	2 days/mile	5,311	25
Drilling and Casing	4 days/well	39,367	65
Well Completion	2 days/well	39,367	165
Compressors (Recip.)	21 days/compressor	298	15
Compressors (Booster)	3 days/compressor	1,060	7
Surface Discharge Facilities	5 days/pond	606	7
Infiltration Facilities	24 days/impoundment	3,091	172
Containment Impoundment	90 days/impoundment	12	3
Land Application Disposal	20 days/facility	68	10
Injection Well	6.5 days/well	305	5
Total			595
<i>Operation and Maintenance</i>			
Road/Pad Maintenance	12 days/pad/year	25,997	199
Pumpers			0
Wells	15 days/pad/year	25,997	245
CMFs	30 days/10 wells/year	3,936	42
General Infrastructure	12 days/pad/year	25,997	196
Office	6 days/well/year	39,367	716
Well Workover	4 days/well/year	39,367	477
Compressors (Recip.)	52 days/compressor/year	298	36
Compressors (Booster)	12 days/compressor/year	1,060	30
Surface Discharge Facilities	25 days/pond/year	606	35
Infiltration Facilities	25 days/facility/year	3,091	179
Containment Impoundment	25 days/facility/year	12	1
Land Application Disposal	12 days/facility/year	68	19
Injection Well	25 days/well/year	305	16
Total			2,191
<i>Decommissioning/Reclamation</i>			
Wells	2 days/well	39,367	33
Roads	2 days/mile	7,136	26
Compressors (Recip.)	20 days/compressor	298	9
Compressors (Booster)	2 days/compressor	1,060	3
Reclamation	5 days/facility	25,997	83
Surface Discharge Facilities	2 days/pond	606	2
Infiltration Facilities	10 days/facility	3,091	55
Containment Impoundment	45 days/facility	12	1
Land Application Disposal	2 days/facility	68	1
Injection Well	2 days/well	305	1
Total			214

Note:

1. Estimates assume 300 working days per year.

it available would essentially be relatively short term. Once the produced water from specific wells diminishes, the beneficial uses supported also would diminish. Thus, beneficial uses also would be short term wherever they would occur.

Alternative Considered: Staged rate or phased development.

Reasons Considered: This alternative was developed in response to a variety of the issues raised during scoping, including concerns about the volume of water discharged to local drainages. Staged or phased development was presented to BLM during scoping in several ways. First, the number of rigs operating in the Project Area could be controlled and leases would be developed in stages. Second, the Companies would be allowed to develop production in one geographic area at a time and when complete, move on to another area. Lastly, corridors could be left undeveloped to allow for wildlife movement.

Reasons Dropped: The State of Wyoming or private parties own much of the minerals and surface in the Project Area and the BLM and FS have no legal authority to direct the Companies in developing these leases. Additionally, the BLM and FS have a legal obligation to ensure that leased federal minerals are fully developed and that production occurring on non-federal leases does not drain federal minerals. This alternative is not reasonable in the case of existing leases because each lessee has an investment-backed expectation that its APDs will be considered in a timely manner and approved absent unacceptable site-specific impacts (see the Supreme Court decision in *Mobil Oil Exploration and Producing Southeast, Inc. v. United States*, 530 U.S. 604, 620 [2000] which found a breach of contract when the Minerals Management Service, pursuant to a later adopted statute, would not review and make a timely decision on development plans per the regulatory scheme in place at lease issuance.)

In addition, the Mineral Leasing Act and 43 CFR 3100 require maximum ultimate economic recovery of oil and gas from leased lands. In light of the broad geographic distribution of leases in the PRB, phased development in any fashion would not allow compliance with the above requirements.

indicate infiltrating CBM produced water dissolves minerals as it interacts with the alluvium, and the resulting water quality is very similar to that of shallow alluvial water along the reach prior to the discharge of CBM produced water. CBM discharges that had an EC of approximately 4,000 Φ S per cm and a SAR of 30 produced alluvial water with an EC of 5,000 to 8,000 Φ S per cm and a SAR of 3 to 8.

Numerous reservoirs and impoundments currently used within the Project Area to manage CBM produced water typically are open systems that are unlined to facilitate infiltration or are designed with an inlet and outlet to allow water to flow through the structure. Constituents of groundwater extracted during CBM development to date, including trace elements, are not likely to have become concentrated in these open systems, as they would if they were contained in a closed system where the volume of water is reduced primarily by evaporation. Data from analysis of water samples are generally not available for reservoirs and impoundments where CBM produced water is stored. Data that are available often represent outfalls authorized by WDEQ that are located near (but not in) reservoirs.

Drilling and completion procedures for CBM wells are strictly controlled by WOGCC and BLM requirements that ensure each formation remains as isolated as it is under natural conditions and that the integrity of the well bore remains intact. Development that occurs in accordance with these requirements is not likely to have allowed any leakage or mixing of groundwater in the formations that were penetrated.

However, leakage and mixing between aquifers of differing water quality likely has occurred where aquifer zones in existing non-CBM wells were not isolated during well completion or abandonment because of a lack of mechanical integrity, including inadequate casing, cementing, or plugging. High pH values are typical in wells contaminated with alkaline cement or bentonite (Bartos and Ogle 2002).

Many existing non-CBM well bores likely do not effectively isolate the formations penetrated and may serve as conduits for mixing of waters from different aquifers. Water wells frequently are screened over multiple aquifer zones, which would facilitate mixing of groundwater from different aquifer zones. Many older, conventional oil and gas wells likely are inadequately cased, which could have allowed any groundwater present to leak from one formation to another. Numerous uncased boreholes were drilled in the PRB to evaluate uranium potential and were not properly plugged, which could have allowed any groundwater present to leak through the formations penetrated. No comprehensive evaluation of the integrity of existing wells within the Project Area has been conducted. Many thousands of water wells, non-CBM oil and gas wells, and uncased boreholes are located within the Project Area.

Alluvial Aquifers

Water quality in alluvium within the PRB is variable. Lowry et al. (1986) report concentrations of TDS for alluvial aquifers that vary from 106 to 6,610 milli-

and eight wells completed in sandstones (Bartos and Ogle 2002; Rice et al. 2002). The locations of wells completed in Wasatch coals or sandstones that were sampled are shown in Rice et al. (2002). Wells located in the central portion of Campbell County, north of Buffalo, and north of Sheridan were sampled. Water produced from the Wasatch Formation varies in composition from mixed-type waters (calcium-magnesium-bicarbonate-sulfate) at relatively shallow depths (less than 200 feet) to sodium-bicarbonate waters at greater depths.

The pH of some samples from Wasatch aquifers exceeds the secondary maximum contaminant level for drinking water established by the U.S. Environmental Protection Agency (EPA) (Bartos and Ogle 2002). Bartos and Ogle (2002) also report dissolved concentrations of some constituents in groundwater from sandstones and coals within the Wasatch Formation. The median concentration of TDS reported for sandstones is 1,010 mg/L, which exceeds the secondary maximum contaminant level for drinking water established by EPA. The median concentration of sulfate is 130 mg/L, which is below the secondary maximum contaminant level for drinking water established by EPA. However, the concentration of sulfate in some samples exceeds EPA's standard for drinking water. The concentration of manganese in some samples analyzed also exceeds the secondary maximum contaminant levels for drinking water established by EPA. The concentration of manganese likely is relatively high because of its higher solubility as Mn^{+2} in anoxic waters. The median SAR is nine.

Hodson et al. (1973) provide an overview of water quality in the Fort Union aquifer. TDS concentrations range from about 200 to more than 3,000 mg/L, but commonly range between 500 and 1,500 mg/L. Water type is mostly sodium bicarbonate, and to a lesser extent sodium sulfate. The water from deep wells is soft, meaning sodium plus potassium exceeds calcium plus magnesium, and many water samples contain carbonate as well as bicarbonate (Rankl and Lowry 1990). The dominant chemical processes that control the chemistry of Fort Union groundwater are cation-exchange softening and sulfate reduction (Rankl and Lowry 1990).

Davis (1976) describes the chemistry of groundwater in the Fort Union aquifer within the eastern PRB. Along the coal outcrop the water generally is calcium-magnesium sulfate type, changing to sodium bicarbonate type westward where confined aquifer conditions exist. There is a relationship between the confined and unconfined state of the aquifer and the chemical quality of water within the aquifer. As a rule, waters within unconfined portions of the coal aquifer are calcium-magnesium-sulfate type and within confined portions of the aquifer are sodium bicarbonate type.

CBM Produced Water

Rice et al. (2002) summarize the major dissolved-ion chemistry of CBM produced water from the Fort Union coal zone within the PRB based on results for 83 groundwater samples from wells completed in the Fort Union coal zone (Table 3-2). The locations of wells completed in Fort Union coal zones that were sampled are shown in Rice et al. (2002). Most wells sampled are located in Campbell County. Most wells sampled in Campbell County are located south-

southwest and south-southeast of Gillette; however, some are located north and west of Gillette. One cluster of wells sampled is located north of Sheridan. A few wells sampled are located in Johnson County. Water produced from the Fort Union Formation is exclusively sodium bicarbonate-type water. The concentrations of iron and manganese in some samples analyzed exceed the secondary maximum contaminant levels for drinking water established by EPA. Concentrations of iron and manganese are relatively high because of their higher solubility as Fe^{+2} and Mn^{+2} in anoxic (without oxygen) waters. Concentrations of barium are relatively high, likely as a result of the low concentrations of sulfate. In waters that contain sulfate, barium has low solubility and forms a precipitate (barium sulfate).

Table 3-2 Composition of CBM Produced Water—Fort Union Formation

Parameter (units)	Minimum	Maximum	Median	DWS ¹
Temperature (°C)	12	29	19	— ²
pH (standard units)	6.8	8	7.3	6.5–8.5
TDS (mg/L)	270	2,720	838	500
Calcium (mg/L)	1.8	68.9	26.3	—
Magnesium (mg/L)	0.6	45.7	14	—
Sodium (mg/L)	109	1,000	270	—
Potassium (mg/L)	3.1	48	7.3	—
Bicarbonate (mg/L)	289	3,134	952	—
Sulfate (mg/L)	<0.3	16.7	X ⁴	250
Chloride (mg/L)	5.1	64.6	10.6	250
Fluoride (mg/L)	0.4	4.13	1.1	2
Iron (mg/L)	0.02	4.9	0.38	0.3
Manganese (mg/L)	0.0014	0.0914	0.0136	0.05
Barium (mg/L)	0.14	1.6	0.6	2
Sodium adsorption ratio	5	68.7	8.8	—

Note:

1. DWS means Drinking Water Standard (Primary or Secondary Maximum Contaminant Level).

2. — means no recommended values.

3. mg/L means milligrams per liter

4. X means less than the minimum reporting level for that constituent.

Source: Rice et al. 2002

Rice et al. (2002) summarize the dissolved trace-element chemistry of CBM produced water from the Fort Union coal zone within the PRB based on results for groundwater samples from wells completed in the Fort Union coal zone (Table 3-3). All concentrations of trace elements are uniformly low and are below the primary and secondary maximum contaminant levels for drinking water established by EPA. There are no noticeable basinwide trends in concentrations of trace elements.

Table 3-3 Trace Elements in CBM Produced Water – Fort Union Formation

Element (Symbol)	MRL ¹ (µg/L) ³	Maximum (µg/L)	Detection Ratio (detections/total samples)	DWS ² (µg/L)
Aluminum (Al)	<50	<50	0/70	50 to 200
Silver (Ag)	<1	<1	0/70	100
Arsenic (As)	<0.2	2.6	38/70	50
Boron (B)	<0.1	390	24/70	--- ⁴
Beryllium (Be)	<0.1	<0.1	0/70	---
Bismuth (Bi)	<20	46	30/70	---
Cadmium (Cd)	<0.1	<0.1	0/70	5
Cerium (Ce)	<0.1	14	2/70	---
Cobalt (Co)	<0.1	0.24	19/70	---
Chromium (Cr)	<1	1.8	10/70	---
Cesium (Cs)	<0.1	0.78	30/70	---
Copper (Cu)	<0.1	29	70/70	1,000
Mercury (Hg)	<0.1	0.25	1/70	2
Lanthanum (La)	<10	<10	0/70	---
Lithium (Li)	<10	208	70/70	---
Molybdenum (Mo)	<0.2	4.1	32/70	---
Nickel (Ni)	<0.5	35	66/70	100
Lead (Pb)	<0.1	0.43	5/70	---
Rubidium (Rb)	<0.1	38	70/70	---
Antimony (Sb)	<2	<2	0/70	6
Scandium (Sc)	<0.1	3	66/70	---
Selenium (Se)	<2	<2	0/70	50
Tin (Sn)	<0.1	5.5	7/70	---
Strontium (Sr)	<0.1	1,900	70/70	---
Thorium (Th)	<20	<20	0/70	---
Thallium (Tl)	<0.2	0.34	1/70	---
Uranium (U)	<0.1	<0.1	0/70	---
Vanadium (V)	<0.2	1.1	1/70	---
Tungsten (W)	<20	51	4/70	---
Yttrium (Y)	<20	<20	0/70	---
Zinc (Zn)	<1	80	39/70	5,000
Zirconium (Zr)	<50	<50	0/70	---

Notes:

1. MRL = minimum reporting level

2. DWS = Drinking Water Standard (Primary or Secondary Maximum Contaminant Level).

3. µg/L means micrograms per liter

4. --- means no recommended values.

Source: Modified from Rice et al. 2002

The median value for TDS (838 mg/L) reported by Rice et al. (2002) exceeds the secondary maximum contaminant level for drinking water established by EPA. The TDS values reported by Rice et al. (2002) indicate that the concentration of TDS increases from south to north and from east to west in the PRB. This increase generally results from an increase in sodium and bicarbonate within the water.

The SAR, a calculation of the abundance of sodium relative to calcium and magnesium in water, also increases toward the west and north, with the lowest values reported near and south of Gillette (Rice et al. 2002). The SAR values range from 5 to 69 and the median value is 8.8 (Rice et al. 2002).

The BLM has summarized and modeled SAR and specific conductance (EC) values for CBM produced water by sub-watershed (BLM 2002). The SAR and EC are physical properties of water that indicate the relative suitability of water for beneficial and state-designated uses. In the near-surface environment, water that contains high SAR values would cause an exchange of ions in clay minerals within soils. In this case, calcium (Ca^{+2}) and magnesium (Mg^{+2}) are exchanged for sodium (Na^+), creating sodium-rich clays with an increased swelling potential and greatly reduced permeability (Rice et al. 2002). The EC is a measure of the capacity of the water to conduct an electric current and indicates the degree of mineralization of the water (Bartos and Ogle 2002).

Data for samples from 132 wells were compiled for analysis and modeling. Data for 122 wells were provided by the USGS (Rice et al. 2002). Data from seven wells were provided by the BLM, the WDEQ supplied data for two wells, and Williams Production Company provided the results of chemical analysis from one well. The well locations are shown in Figure 3-1.

Because of the limited amount of data for the Upper Tongue River, Clear Creek, and Crazy Woman Creek sub-watersheds, it was necessary to estimate one data point in the north-central portion of the basin (T57N R79W). Values for SAR and EC at this data point were calculated by averaging values from the two closest data points. The estimated point was required to permit modeling of data from the widely spaced wells without generating anomalies in the SAR/EC model grid.

Data from each well were imported into contouring software and transformed into a uniform grid with a spacing of 400 by 400 meters over the Project Area. The grid points generated were exported as X – Y – Z coordinates to allow spatial analysis and data interpretation. The values for SAR and EC in each sub-watershed and the interpreted variations in SAR and EC values within the Project Area are shown in Figure 3-1.

Confined (Artesian) vs. Unconfined Conditions

The groundwater resources contained in alluvial aquifers are under unconfined or water table conditions (Whitehead 1996). Normally, clinker is an unconfined aquifer (Heffern and Coates 1999). Groundwater resources contained in the Wasatch aquifers occur under partially confined conditions (Whitehead 1996).

The Fort Union coal zone aquifers are hydrologically confined, except near the land surface (Hotchkiss and Levings 1986). Artesian conditions can exist (Bartos and Ogle 2002). Gas present within the coal beds and in underlying or overlying

puted to be 100 to 200 feet in extensively developed areas (AHA and Greystone 2002). However, water levels can vary considerably over short distances due to changes in geologic conditions. The greatest existing drawdowns are interpreted to occur in the following four townships: T.47N. R.72W.; T.48N.R.72W.; T.47N. R.73W.; and T.48N. R.73W.

CBM development within the PRB has generated detailed water yield information for the coal zones within the Fort Union aquifer. The increase in water production from CBM wells between 1990 and 2000 is shown in Figure 3-3. Data on the production of water from CBM wells in the PRB are summarized by sub-watershed (hydrologic unit) for 2000 and 2001 in Table 3-6.

Table 3-6 Water Production from Pre-2002 CBM Wells, Powder River Basin

Sub-Watershed	Number of Pre-2002 CBM Wells ¹	2000 Water Production (barrels) ²	2001 Water Production (barrels) ²
Upper Tongue River	819	6,590,722	26,984,948
Upper Powder River	2,808	42,736,739	90,426,440
Crazy Woman Creek	150	28,706	9,862
Clear Creek	389	43,877	301,126
Middle Powder River	727	7,563,589	19,034,451
Little Powder	1,814	66,667,649	79,325,493
Antelope Creek	251	1,769,502	7,209,092
Upper Cheyenne River	401	48,491,981	46,919,356
Upper Belle Fourche River	4,659	200,409,537	242,735,454
Middle North Platte River	6	0	524
Total	12,024	374,302,302	512,946,746

Notes:

1. Pre-2002 wells include all wells drilled or authorized, and projected for completion by 2002. Production shown for 2000 and 2001 comes from these wells. Not all pre-2002 wells produced during 2000 or 2001.
2. Data were compiled from WOGCC (2001b, 2002b); one barrel equals 42 gallons.

Water yield from the Lebo confining layer has been described by Lewis and Hotchkiss (1981). Wells penetrating a sufficient saturated thickness of lenticular channel deposits may yield as much as 10 gpm.

Water yield from the Tullock aquifer has been described by Lewis and Hotchkiss (1981). Fine-grained sandstones and jointed coal beds may yield as much as 40 gpm, but yields of 15 gpm are more common. Where the aquifer is confined, wells generally flow less than 10 gpm.

Groundwater Use

Rankl and Lowry (1990) describe water wells and groundwater use in the PRB. Water wells generally are less than 500 feet deep and principally support livestock and domestic uses. These shallow wells generally produce calcium sulfate or calcium sodium sulfate waters. Yields from shallow wells completed in sandstone aquifers generally are about 20 gpm. Deep wells yield larger quantities of water that generally is a sodium bicarbonate type. Water from alluvium has not

An estimated 46 percent of the permitted non-CBM water wells in the Project Area are completed in the Wasatch Formation. An estimated 34 percent of the permitted non-CBM water wells are completed in the Fort Union Formation. No formation name is available for the remaining almost 20 percent of the wells.

Figure 3-4 shows the relative numbers of permitted water wells and existing CBM wells located within the Project Area. The Upper Belle Fourche River and the Upper Tongue River sub-watersheds contain the largest number of permitted non-CBM water wells, 23 percent for the Upper Belle Fourche and 16 percent of the totals for the Project Area in the Upper Tongue River.

Surface Water

Regional Characterization

The Project Area is contained within several large river basins, which are headwaters to the much larger Missouri River Basin. Major rivers in the Project Area include the Powder River, Little Powder River, Tongue River, Belle Fourche River, and Cheyenne River. The major river valleys have wide, flat floors and broad floodplains. Tributaries in the Project Area are incised in and drain areas of isolated, flat-topped, clinker-covered buttes and mesas, 100 to 500 feet above the valley floor. Flow in the Project Area is generally toward the northeast. Perennial streams generally originate in the mountainous areas as a result of significant annual precipitation and geologic conditions that foster groundwater discharge.

The Project Area is semi-arid with average annual precipitation ranging from 12 to 16 inches. Precipitation increases with elevation and can exceed 20 inches in some portions of the Project Area. Normal annual precipitation increases generally eastward in the downstream direction (Taylor 1978). The majority of annual runoff in streams draining mountainous areas occurs during spring and early summer as a result of snowmelt. Nearly one-half of the average annual precipitation occurs during the months of April, May, and June (Rankl and Lowry 1990). Streamflow generally peaks during June, but varies from year to year depending on both local weather conditions and physical features of individual basins. Late summer, fall, and winter flows are largely the result of groundwater inflows. Minimum streamflows occur generally from January through March (Lowham 1988).

Surface water quality in the Project Area is generally adequate to support designated uses. Surface waters in the Project Area are typically alkaline, with moderate to high levels of hardness. These waters vary from a calcium bicarbonate type in the mountain streams, to a sodium sulfate type in the lowlands. Surface water quality in the Project Area is affected by depletions and return flows from irrigation. Surface water withdrawals in the Project Area are used to support agricultural, domestic, and stock water uses. Irrigation use accounts for about 98 percent of the surface water withdrawals in the Project Area.

Natural Streamflow

Statistics on flow statistics have been compiled from selected USGS stream gauging stations to provide a perspective of perennial stream flow within the Project Area. This information is summarized in Table 3-8. Baseflow conditions in the streams are represented by the low of the mean monthly flows in the streams and typically occur in the winter months. Conversely, high flow conditions in the streams are represented by the maximum of the mean monthly flows, and typically occur during periods of snowmelt runoff or significant precipitation events. Critical low flow conditions are represented by a 7Q10 flow, defined as the lowest flow during 7 consecutive days with a 10-year recurrence interval.

Streamflow characteristics in the Project Area depend on the specific features unique to each drainage basin. These features include geology, topography, vegetative cover, size, and climate. Flow regimes in the Middle Fork Powder River are representative of streams that originate in the mountainous areas of the Project Area. Flows in these streams are perennial and influenced by snowmelt in the late spring and early summer (Clark et al. 2001). Base flows are generally sustained by groundwater discharge. Flow regimes in the Little Powder River are representative of the streams that originate in the plains region of the Project Area. Flows in these streams generally are more variable than are flows in the mountain streams and are influenced by lowland snowmelt during the late spring and early summer, as well as from rainstorms during the remainder of the summer and fall. These streams are more likely to have little or no flow during the late summer and early winter (Clark et al. 2001). Flow regimes in the Upper Powder River exhibit characteristics of streams originating in both the mountainous and plains regions of the Project Area. Flows are generally more variable throughout the year than flows in mountain streams, and periods of little or no flow still occur but with less frequency than for plains streams (Clark et al. 2001). Flows in the Project Area are further influenced by irrigation diversions and releases from storage reservoirs.

Peak Flow/Stormwater Flow

Peak flows to date in the northern portion of the Project Area occurred in May 1978, when the region experienced a flood of 1 percent probability, or a flood so large that there is only a 1 percent chance that a similar flood would exceed its magnitude in any year (Parrett et al. 1984). Peak flows during this event measured 5,300 cfs in the Little Powder River, 33,000 cfs in the Middle Powder River, 17,500 cfs in the Tongue River, and 15,300 cfs in the Upper Belle Fourche River. Flood events in September 1923 in the Upper Powder River (100,000 cfs) and June 1965 in Crazy Woman Creek (15,800 cfs) were the peak flows recorded to date in the southern portion of the Project Area (Swanson et al. 2002).

Treatment

Treatment of the produced water is used to amend the water quality to meet NPDES standards for surface discharge. Treatment methods may be passive, such as implementation of BMPs for oxidation and precipitation of iron before surface discharge. BMPs implemented for removal of iron include the addition of rip-rap, trickle towers, perforated pipe, and aeration systems (O&G 2001). Active treatment would use a chemical process, a reverse-osmosis process, or a combination to reduce SAR values, barium concentrations, or other constituents of concern. Pilot testing using active treatment has been performed with varying degrees of success; however, to date, no full-scale projects have been installed (WRGI 2001).

Physiography, Geology, Paleontology, and Mineral Resources

Physiography

The PRB is part of the Missouri Plateau of the Great Plains (Trimble 1980). This region is characterized by rolling uplands that have been greatly dissected by tributaries of the Missouri River system. The great continental glaciers never extended into the PRB. The Bighorn Mountains, which are part of the Rocky Mountains, lie just west of the PRB, partially within the westernmost portion of the Project Area. The east slope of this imposing mountain barrier, facing the PRB, is steep and rugged for the most part, and is cut by many deep, narrow canyons (Keefer 1974).

The PRB is a structural basin extending about 220 miles from north to south, and generally less than 95 miles from east to west, that formed at the foot of the Bighorn Mountains. The PRB is bounded on its margins by upturned rocks or mountainous masses rising from the plains. On the east, the PRB is bounded by the Black Hills. On the south, the PRB is bounded by the Casper arch, the Laramie Mountains, and the Hartville Uplift (Macke 1993). To the north and northeast, the terrain of the PRB merges with, and cannot be distinguished from, the remainder of the Missouri Plateau (Keefer 1974).

The PRB consists of a dissected, rolling upland plain with low to moderate relief, broken by buttes, mesas, hills, and ridges. Extensive areas of open high hills in the northern portion of the Project Area indicate rough, broken terrain where moderate to deep erosion has occurred (Keefer 1974). Erosion-resistant clinker, produced by the natural burning of coal beds in the PRB, caps many hills and ridges within the Project Area with a characteristic broken, red brick or scoria-like rock. Elevations in the Project Area range from 3,350 to 9,250 feet above msl.

The present-day landforms of the semi-arid PRB have been shaped mostly by the action of water, even though precipitation is low and evaporation greatly exceeds precipitation. The drainages dissecting the Project Area are incised, typically are

of the Project Area. Coal from the PRB in Wyoming is valued for its clean-burning properties.

Glass (1997) describes important coal seams of the Powder River Coal Field in Wyoming. These descriptions are summarized in the following paragraphs. Important coal seams within the Wasatch Formation, from oldest to youngest, include the School, Badger, Felix, and Lake De Smet coals. Important coal seams within the Fort Union Formation, from oldest to youngest, include the Canyon, Anderson, Wyodak, and Big George coals.

The School and Badger coals within the Wasatch Formation are developed in the Dave Johnston deposit in the southern part of the PRB. The Felix coal is a persistent coal bed in the northern and central portions of the Project Area, and varies between 5 and 20 feet thick, but is up to 50 feet thick in the central and southern portions of Campbell County. Felix coal exposures located east of the Powder River in southern Campbell County have been burned (Coates and Heffern 1999). The Felix coal is not currently mined.

The Lake De Smet coal is the thickest known coal seam in the contiguous U.S. Although limited in areal extent, in the northwestern portion of the Project Area the Lake De Smet coal attains a thickness of 250 feet. The Lake De Smet coal is not currently mined, and the uppermost portions of this coal bed are burned over much of its area of occurrence.

The Canyon coal of the Fort Union Formation is a persistent 10 to 65 feet thick coal bed over most of the Project Area. It is correlative with the Monarch coal in the Sheridan area. The Anderson coal is well developed throughout most of the Project Area, and coalesces with the Canyon coal in the Gillette area to form the thick Wyodak coal, which is 25 to 190 feet thick and averages 100 feet thick. The Wyodak coal has the largest strippable reserve base of any coal bed in Wyoming. In 2000, 12 surface coal mines located in Campbell and Converse Counties produced 323 million tons of coal from the Wyodak coal zone. The mines are located near the eastern boundary of the Study Area, near the outcrop of the Wyodak coal (Figure 2-1 and Figure 3-6), where the overburden thickness is lowest. Extensive clinker deposits exist east of many of the coal mines, which resulted from the spontaneous burning of the Wyodak coal near its outcrop.

Westward from Gillette the Wyodak coal splits into an Upper Wyodak coal composed of the Anderson and Canyon coals, and a lower, less persistent, Lower Wyodak coal. North of Gillette the Wyodak coal splits into an Upper Wyodak coal (including the Anderson coal) and a Lower Wyodak coal (including the Canyon coal). Farther west near the Campbell and Johnson County line, the Upper Wyodak coal thickens and becomes the Big George coal. However, in areas southwest of Gillette, both the Wyodak and the Big George coals are present, with the Big George coal zone positioned stratigraphically above the Wyodak coal zone.

The Big George coal is not exposed at the surface. It is reportedly up to 200 feet thick and averages more than 100 feet thick. It occurs in the subsurface of the

west central portion of the PRB at depths between 1,000 and 2,000 feet and is not currently mined.

Coal resources in the northwestern portion of the Project Area are summarized by the BLM (1999b). The prominent coal beds within the Tongue River member of the Fort Union Formation are, from oldest to youngest, the Carney, Monarch, Dietz 3, Dietz 2, Dietz 1, Anderson, Smith, and Roland coals. North of Sheridan, underground coal mines operated between 1894 and 1953. Surface mining began in 1944 and continued until 1996. Two active surface coal mines (Decker and Spring Creek) are located northwest of the Project Area in southern Montana.

Most of the coal in the Project Area is federally owned. These federal coal lands are within the Wyoming portion of the decertified Powder River Federal Coal Region (BLM 1999c).

Coal Bed Methane

About 25 trillion cubic feet (tcf) of CBM may be recoverable from coal beds in the PRB within Wyoming (WSGS 2001). For this estimate, data for coals greater than 20 feet thick, occurring deeper than 200 feet below the surface were used, and a recovery factor of 67 percent was assumed. The BLM estimated that 28 tcf of CBM may be recoverable in the development scenario prepared for the PRB (Appendix A). Estimates of recoverable CBM in the U.S. increased from 90 to 141 trillion cubic feet (tcf) over 10 years as a result of technological advances (USGS 2000). Advances in technology likely would continue to result in improved evaluation and recovery of CBM resources.

De Bruin et al. (2001) describe CBM resources occurring in the PRB. CBM is natural gas (methane) occurring in coal beds. In the PRB, CBM was formed as buried plant material was subjected to bacterial activity during emplacement of groundwater and coalification (conversion to coal). CBM in the Powder River Coal Field is composed almost entirely of methane (CH₄) and nitrogen (N) (Gorody 1999).

A large percentage of the CBM generated during coalification escapes to the surface or migrates into nearby rocks, but a portion is trapped within the coal beds (De Bruin and Lyman 1999). Gas is trapped and stored in coal beds in one of four ways: (1) as free gas in tiny pores or cleats (fractures) within the coal; (2) as dissolved gas in water within the coal; (3) as adsorbed gas on coal surfaces; or (4) as absorbed gas within coal molecules (De Bruin et al. 2001).

Although it has been known for many years that methane often vents from shallow water wells and coal exploration drill holes in the PRB, drilling for CBM began only in 1986 (De Bruin and Lyman 1999). The first economic production of CBM from the PRB occurred in the Rawhide Butte field just north of Gillette, where production began in 1989 (De Bruin and Lyman 1999, Sawyer and Jeffries 1999). CBM development has been expanding rapidly since 1993 (Flores et al. 2001) and began accelerating in 1997 (De Bruin et al. 2001).

To help obtain this information, the BLM has sent out letters to tribes and is seeking to meet with all applicable tribes to discuss their concerns. The BLM has also invited the tribes to tour the planning area to begin to identify areas of traditional importance where impacts could occur.

Land Use and Transportation

Land Use

This section discusses the existing land surface and mineral ownership, land uses, and land use management and planning in the Project Area.

Regional Characterization

The BLM-administered lands within the Project Area include both the BFOA and the CFOA. In Campbell, Johnson, and Sheridan Counties, BLM lands within the Project Area are administered by the BFO. For the northern portion of Converse County within the Project Area, BLM lands are administered by the CFO.

FS-administered lands in the Project Area include portions of the TBNG administered by the Medicine Bow-Routt National Forest. The TBNG is located in the eastern portions of Campbell and Converse Counties.

Land ownership in the Project Area consists primarily of private lands intermingled with federal and state lands, as shown on Figure 3-17. Mineral ownership in the Project Area consists primarily of federal mineral estates as shown on Figure 3-17. Rangeland/livestock grazing is the dominant land use for both public and private lands in the Project Area. The management of planned future land uses within the Project Area is also discussed for BLM- and FS-administered lands, state-owned lands, and the local governments.

Land Status/Surface Ownership

The distribution of surface ownership of the land within each watershed of the Project Area is summarized on Table 3-62 and shown on Figure 3-17.

Approximately 76 percent of the surface ownership in the Project Area is private land. The State of Wyoming owns 9 percent of the surface land within the Project Area. Federal land comprises 14 percent of the Project Area.

Federal lands within the Project Area are administered by the BLM BFO and CFO and the FS and consist of numerous noncontiguous tracts of land surrounded by private lands. Approximately 10 percent of the lands within the Project Area are federally owned within the BFOA. Within the CFOA, 1 percent of the land is federally owned. FS-administered lands in the area include portions of the TBNG administered by the Medicine Bow-Routt National Forest. The TBNG is located in the eastern portions of Campbell and Converse Counties. Approxi-

mately 3 percent of the lands within the FS-administered lands within the Project Area are federally owned.

Mineral Ownership

The mineral estate (mineral ownership) within the Project Area is shown in Figure 3-18. Many areas of the Project Area are considered “split-estate,” meaning the surface owner is different from the owner of the mineral rights. For example, the surface may be privately owned but the mineral estate is, at least in part, federally owned. In addition, there may be more than one owner among the different mineral estates. For example, the federal government may own only the oil and gas mineral resources, while coal and other mineral resources on the same lands are owned by the state or private parties. For CMB operations where the mineral resource is federally owned and the surface is privately owned, the operator is responsible for reaching an agreement with the private surface owner for access to the property under regulations at 43 CFR Part 3814. Based on the discretion of the surface owner, a surface use agreement also may be required.

The mineral ownership within each sub-watershed in the Project Area is shown on Table 3-63. The categories of mineral ownership shown include several categories that must be combined to determine the total federal ownership for oil and gas rights. Total oil and gas ownership includes the sum of properties with federal ownership of all mineral rights; oil and gas rights only; oil, gas and coal rights only; and oil, gas, coal and other minerals (but not all mineral rights). The mineral category “other” includes locatable minerals (bentonite, uranium, and others) and salable minerals (sand, gravel and scoria).

Most of the oil and gas mineral estates within the Project Area are federally owned. Within the BFOA, 63 percent of the oil and gas mineral estate within the Project Area is federally owned. Approximately 63 percent of the oil and gas minerals for that portion of the Project Area within the CFOA are federally owned. Within the FS-administered lands of the Project Area, approximately 52 percent of the oil and gas rights are under federal ownership.

Existing Land Uses

Several primary land uses occur within the Project Area as shown on Figure 3-19, and as discussed in the following sections. The land use categories for the BLM-administered lands for both the BFOA and the CFOA, and the FS-administered lands within the Project Area are shown on Table 3-64 and summarized in the following discussion.

Agriculture

Agricultural land uses within the Project Area include cropland and pasture, confined feeding operations, and other agricultural uses. Most of the cropland in the Project Area is not irrigated; however, irrigated cropland occurs in limited areas, primarily adjacent to drainage ways.

Chapter 4 — Environmental Consequences

This chapter of the EIS provides an analysis of the effects (environmental consequences) that would result from implementation of the Proposed Action and alternatives. An environmental effect or consequence is defined as a modification or change in the existing environment brought about by the action taken. Effects can be direct, indirect, or cumulative and can be temporary (short term) or permanent (long term). Effects can vary in degree, ranging from only a slight discernable change to a drastic change in the environment. For this EIS, short-term effects are defined as occurring during the construction and drilling/completion phases. Long-term effects are caused by construction and operations that would remain longer.

The analysis evaluated the effects that would occur in the Project Area, regardless of land ownership. However, the decisions on this project by the BLM and FS would apply only to federal lands. The effects reported for non-federal lands may occur regardless of the BLM and FS' decisions. Effects on non-federal lands are included to provide a full disclosure of effects for the complete project and to support other environmental permitting associated with the project.

Groundwater

During development of CBM, a portion of the water contained in the coal aquifer is removed from CBM wells as produced water. The primary effects on groundwater resources would be associated with the removal of groundwater stored in coal seams and the subsequent recharge of aquifers through infiltration or injection of produced water. The combined effects of coal mining and other existing or reasonably foreseeable conditions on groundwater resources also are described within this chapter.

The effects of development of CBM on groundwater resources would be seen as a drop in the water level (drawdown) in nearby water wells completed in the developed coal aquifers and underlying or overlying sand aquifers. Drawdown is observed when a loss in hydraulic pressure head occurs in the developed coal aquifers or in the overlying and underlying sand aquifers. The hydraulic pressure head is the vertical distance between the water level in a water well and the top of the confined aquifer in which the well is completed.

Partial removal of groundwater from a coal seam (through coal mining operations or development of CBM) would reduce the hydraulic pressure head and create a hydraulic gradient toward the well or excavation. There would be a progressive decline in hydraulic pressure head with time and distance as groundwater flows into a pumping well or excavation. The effects would be seen as progressive declines in the water level (drawdown) within nearby water wells completed in and near the developed coal aquifers.

Leakage of groundwater from underlying and overlying units into the coal aquifer would initiate recovery in nearby water wells completed in the coal aquifer. Recovery would continue as CBM produced water that infiltrates the surface reaches the sand and coal aquifers. However, continued leakage of infiltrated produced water from overlying and underlying sands into the coals would delay noticeable recovery of the sands until removal of water ends. Water levels in nearby water wells would be expected to recover after removal of water ends. The rate of recovery initially would be rapid because of the re-equilibration of pressure heads within the coal and leakage from overlying and underlying units. The rate of recovery in the coal and sand aquifers would decrease progressively during the recovery period as the enhanced infiltration of produced water declines.

Other potential effects on existing water wells would include changes in water yield and quality or methane emissions. Other effects on groundwater resources would consist of potential changes in groundwater chemistry, in the nature of groundwater discharge to the surface, or recharge to the aquifers. The nature of groundwater discharge to the surface as springs, seeps, or base flows of surface drainages could change. Surface discharge of extracted groundwater from CBM operations into surface drainages, flow-through stock reservoirs, upland or bottomland infiltration impoundments, or upland containment impoundments would enhance recharge of shallow aquifers below creek and impoundment areas. Injection of CBM produced water would recharge the aquifer units in which the injection wells are completed.

Overview: Regional Groundwater Model

Hydrogeologic Groups

A detailed description of the geology and hydrology of the area is provided in Chapter 3. This analysis focuses on the coal seams of the upper part of the Fort Union Formation, the sands of the overlying Wasatch Formation, and the alluvium that underlies surface drainages.

The Wasatch Formation is exposed at the surface over most of the Project Area and overlies the Fort Union Formation. The Wasatch Formation consists of fine-grained sandstones, siltstones, claystones, and coals. The sandstones tend to be discontinuous but are used locally for water supply. Coal zones generally are not economic for mining or development of CBM, except in the area of Lake De Smet near the western margin of the PRB. Siltstones and claystones typically are of low permeability and form hydraulic confining units (or aquitards) within the Wasatch sequence.

The Fort Union Formation consists of coals, sandstones, siltstones, and claystones. The coals of the upper Fort Union Formation show great variation in thickness and continuity over the PRB. Coal seams split and merge over distances of a few miles so it is more appropriate to consider the coals as part of a hydrogeologic group rather than as individual aquifers. The upper sequence of the Fort Union Formation has been subdivided for this analysis into four hydro-

geologic groups defined on the basis of the stratigraphic correlation of coal seams (Goolsby, Finley, and Associates 2000).

All four coal groups can be identified in the northern part of the PRB. Groups 1, 2, and 3 merge to form a thick coal unit, known as the Big George, in the central portion of the PRB. Only Group 4 is present in the southeastern part of the PRB, where it is locally known as the Wyodak coal. The outcrop areas of the coal seams are characterized by the presence of highly permeable clinker that forms a recharge area for the coal.

Assumptions for Groundwater

Recharge to groundwater aquifers occurs from direct infiltration of precipitation (rain and snowmelt), runoff in creek valleys, and standing water in playas. Infiltration is significant in areas of more permeable surface geologic units, such as sandstone or the clinker that occurs in outcrop areas of the Fort Union and Wasatch Formations. Direct infiltration of precipitation provides a minimal source of recharge over most of the area because the climate and surface features prohibit significant infiltration.

Early (pre-mine) data on water levels indicate that hydraulic gradients for the coal and clinker are steep near the outcrop with highest potentials in the clinker, suggesting that the clinker provides recharge to the coal. However, the rate of recharge from the clinker units to the coal is often limited by a relatively low-permeability, clay-rich zone that typically occurs at the contact between the clinker and the coal.

Infiltration of surface water in creek valleys is considered an important source of recharge to the underlying alluvium and the shallow bedrock aquifers. A USGS study of two ephemeral drainages in the southern part of the PRB indicated stream losses of between 0.43 and 1.44 acre-feet per mile from individual storm runoff events (Lenfest 1987) and these values were acknowledged to be underestimated. Recharge to shallow aquifers from stream valleys ranged from 3.56 to 26.5 acre-feet per mile for individual storm runoff events in the same study. Recent studies of the losses of surface water in several drainages of the PRB that receive CBM produced water during dry weather indicate that conveyance losses range from 64 percent to 100 percent of inflows (Babb 1998, Meyer 2000b, AHA 2001b).

Conveyance losses include both evapotranspiration and leakage into alluvium and bedrock that underlie the streams. Evapotranspiration varies seasonally, but probably accounts for less than 20 percent of the conveyance losses over the course of a year. A monthly water balance calculation for the Wild Horse Creek drainage found that evapotranspiration accounted for 18 percent of the conveyance loss associated with the surface discharge of CBM produced water within the drainage basin (Hydrologic Consultants Inc. 2001). Recharge of shallow aquifers through leakage from rivers or streams probably accounts for more than 80 percent of the conveyance loss.

Discharge of CBM produced water to surface drainages was assumed for this analysis to result in a 20 percent total conveyance loss, of which 82 percent

Stream Water Quality

Representative EC and SAR values for streams in the Project Area were obtained from analysis of the historical record at USGS stream monitoring stations (Meyer 2002b). This information is presented in Table 3-11. EC and SAR values that correspond to mean monthly flow conditions were used in the surface water impact analysis.

CBM Discharge Rate

BLM analyzed water production data from existing wells that were downloaded from the WOGCC web page to project total water production on an annual and an over the life of the project basis by sub-watershed (BLM 2002). For the Upper Belle Fourche, Antelope Creek, and the Upper Cheyenne River sub-watersheds, the number of wells and corresponding flow rate per well in the peak year of water production were used as input parameters in the surface water impact analysis. The average peak discharge rate in these sub-watersheds is 7.0, 11.9, and 9.6 gpm per well, respectively. A value of 6.2 gpm per well, which represents a basin-wide (Wyoming and Montana) average production rate during the peak year of water production, was used in the Powder River, Little Powder River, and Upper Tongue River sub-watersheds.

CBM Water Quality

BLM has summarized and modeled EC and SAR values for CBM produced water by sub-watershed (BLM 2002). This information is shown in Figure 3-1. Mean values for EC and SAR were used in the surface water impact analysis. The EC and SAR values used in the impact analysis in the Upper Cheyenne River sub-watershed represent a flow-weighted average of the combined discharges from the Antelope Creek and Upper Cheyenne River sub-watersheds. The EC and SAR values used in the impact analysis in the Middle Powder River sub-watershed represent a flow-weighted average of the combined discharges from the Salt Creek, Clear Creek, Crazy Woman Creek, Upper Powder River, and Middle Powder River sub-watersheds.

Model Assumptions

The following assumptions form the framework for evaluating the impacts in this analysis:

- Discharge of CBM produced water to surface drainages was assumed to result in a conveyance loss of 20 percent. This value is considerably lower than the values derived from studies of surface water losses in creek flows within several drainages of the PRB (Meyer 2000b, AHA 2001b). These previous studies were limited geographically to specific areas of the PRB and did not account for certain times of year (especially winter) when evaporation and evapotranspiration losses would be reduced. Therefore, the value used in this model for conveyance loss was decreased between the DEIS and FEIS to account for these conditions. The remaining 80 percent of the CBM produced water discharged to surface drainages was assumed to reach the main stem in each sub-watershed.
- Where produced water is discharged to infiltration impoundments designed to allow infiltration, 15 percent of the water would resurface and contribute

to in-channel flow; the remainder would infiltrate into the shallow aquifer system.

- CBM produced water that is actively treated was assumed to be 100 percent consumptively used because of its higher quality.
- Water produced from CBM wells and managed through containment, LAD, and injection would not have direct effects on quantity and quality of surface water because, by definition (see Chapter 2), none of the discharged water under these options would reach drainages in the sub-watersheds. Indirect effects from implementation of these water handling options, such as potential effects to waterfowl from evaporative concentration of CBM discharged waters in containment impoundments and potential effects on soils and vegetation from LAD, are discussed in subsequent sections.
- The percentage of CBM water production handled by active treatment, containment, LAD, and injection, and the proportion of water lost to the shallow aquifer system from infiltration impoundments is summarized collectively as Managed Water Loss.
- It was assumed that the sodium and salinity content of water produced from CBM wells are the target constituents that control the usefulness of the water for irrigation of crops. Irrigation is the primary beneficial use for the majority of water resources in the sub-watersheds expected to have the greatest potential for CBM development, especially with respect to the Montana portion of the PRB. Sodium causes osmotic stress to plants and destroys the texture of clayey soils; these combined effects make sodium content, and especially SAR, a point of emphasis when evaluating impacts to water resources from CBM water. The salinity of irrigation water, as expressed by EC, affects crop productivity.
- EC and SAR values for resulting mixtures of existing stream water and CBM discharge water under various flow conditions are compared with the MRPL and LRPL listed in Table 4-2. A comparison was also made between the existing and resultant water quality using the Ayers and Westcot (1985) irrigation suitability diagram, which compares water quality before and after mixing in terms of suitability for irrigation and especially for impacts on soils irrigated with the water. Elevated values of SAR may reduce the permeability of soil, thereby reducing the rate of water infiltration. The Ayers-Westcot diagram was also used to evaluate the proportion of CBM discharge that could reasonably occur under various flow conditions without causing potential effects to infiltration. The proportion of CBM discharge specified includes managed water losses described under each alternative. The irrigation season is defined for this analysis as the period April 1 through October 31.
- The impact analysis did not consider changes in water quality that may occur as the CBM discharge flows overland toward the main stem streams or as it infiltrates to shallow groundwater systems and is discharged to surface flows. Water quality and flow monitoring results from the tributary monitoring program suggest that CBM discharges tend to pick up salts (EC) from

the soils and alluvium as they flow down tributary channels and that SAR values decrease (AHA 2001a). Thus, CBM discharges improve between the discharge point and the receiving stream with respect to SAR but worsen with respect to EC. Therefore, using the water quality of the CBM discharge provides a more conservative estimate of the impact on surface water of the main stems.

- The impact analysis did not consider individual constituent (sodium, calcium, and magnesium) values in determining the resultant SAR values. This assumption is inherently conservative (Greystone and ALL 2002).

Comparison of Alternatives

Surface water flow is expressed in this analysis in cubic feet per second, or cfs. The water produced from wells is expressed in gallons per minute, or gpm. One cfs is equivalent to 448.83 gpm. Large flows or volumes of water are expressed as acre-feet. One acre-foot is equivalent to 43,650 cubic feet, or 325,851 gallons.

Alternative 1

Under Alternative 1, CBM produced water flows would be handled through direct discharge to surface drainages, passive treatment before surface discharge, discharge to upland and bottomland infiltration impoundments, discharge to containment impoundments, LAD, and injection (Table 2-9). With surface discharge, CBM produced water flows would be gathered for discharge at outfalls authorized in accordance with guidance and requirements of the State of Wyoming (WDEQ and possibly WSEO). Passive treatment would be employed primarily to remove iron, and under Alternative 1, would occur only in the Upper Tongue River, Middle Powder River, and Clear Creek sub-watersheds.

BLM analyzed water production data from existing wells downloaded from the WOGCC web page to project total water production on an annual and an over the life of the project basis by sub-watershed (BLM 2002). This analysis assumed that all of the 12,024 existing wells would produce water before 2002 and that water production for the last of the existing wells to be drilled ends after 2007. Water production from the last of the 39,367 new wells to be drilled is assumed to conclude at the end of 2017. Projected CBM water production under Alternatives 1, 2A, and 2B is shown in Table 2-8.

Under Alternative 1, the maximum CBM water volume produced annually is expected to increase from an estimated 109,429 acre-feet per year produced from existing CBM wells in 2001 to an estimated 386,336 acre-feet per year in 2006. The peak year of water production by sub-watershed varies, and these years were modeled in the surface water impact analysis to evaluate effects from CBM produced water discharges.

Alternative 2A

Under Alternative 2A, CBM produced water would be handled by the same methods specified in Alternative 1 (Table 2-21). Use of upland and bottomland infiltration impoundments would be emphasized. With the exception of a propor-

Cumulative effects to the suitability for irrigation of the Powder River would be minimized through the interim MOC that the two DEQs have signed. This MOC was developed to ensure that designated uses downstream in Montana would be protected while CBM development in both states continued. As the two states develop a better understanding of the effects of CBM discharges through the enhanced monitoring required by the MOC, they can adjust the permitting approaches to allow more or less discharges to the Powder River drainage. Thus, through the implementation of instream monitoring and adaptive management, water quality standards and interstate agreements can be met.

Of course site-specific conditions and the actual surface water standards adopted by the MBER will be the most important factors in determining the actual water management practices within the Montana portion of the PRB. The MDEQ cannot allow discharges of CBM water to impact surface water conditions in excess of prevailing regulations and standards. CBM producers in the Wyoming portion of this watershed will be held to the same standards if the Montana standards are approved by the EPA and given CWA standing.

Effects from each Alternative Common to All Sub-Watersheds

Alternative 1

Surface Drainages

Potential effects from discharges of CBM produced water to surface drainages within the Project Area include alteration in flow, erosion, degradation of the stream channel, and increased sedimentation. Potential effects would be most pronounced during periods of historical low flow. Surface drainages may be affected by the discharge of CBM produced water where channels are not stable, armored, or large enough to accommodate the anticipated flows. Localized flooding may occur with increased frequency and magnitude where the capacity of the channel or basin is insufficient to handle the increased flows. In contrast to naturally occurring flows, which fluctuate significantly with changing seasons, flows generated by discharges of CBM produced water occur year-round with small fluctuations. Site-specific Water Management Plans (Appendix I) submitted at the APD and POD level of analysis would be an integral part of mitigation planning to control and monitor the potential effects from increased flows in surface drainages.

Conveyance losses caused by evapotranspiration and infiltration would minimize the volume of discharged CBM produced water that would reach the main stems of surface drainages. However, draws that previously were ephemeral could become perennial downstream from clustered outfalls that discharge large volumes of CBM produced water. Modeled conditions assumed a single conveyance loss, whereas actual conveyance loss would vary. Higher conveyance losses would correspond to unsaturated stream channel conditions. Locating surface discharge outfalls higher up in ephemeral or intermittent drainages would encourage conveyance loss, as these drainages would essentially be under unsaturated conditions. Conveyance losses would be minimal when CBM produced water is discharged into perennial waterways. Conveyance losses would likely be signifi-

cantly reduced during prolonged cold winters, enhancing runoff and areas of standing water during the spring melt.

Wyoming's 2002 Clean Water Act 303(d) list identifies water bodies within the Project Area that do not support all of the designated uses (WDEQ 2002b). Pollutants of concern causing existing impairments to water quality in the Upper Tongue River, Upper Powder River, and Upper Belle Fourche River sub-watersheds include temperature, selenium, chloride, and fecal coliform. CBM discharges should not aggravate the impaired waterbodies for these pollutants of concern on the listed waterbodies. If these pollutants do become a concern from CBM discharge, they would be controlled through the NPDES permit. Surface drainages would also likely exhibit iron staining below designated outfalls, where CBM produced water that is typically high in iron would be discharged. Iron staining would be less evident in the Upper Tongue River, Clear Creek, and Middle Powder sub-watersheds where NPDES permit requirements for passive treatment of iron in CBM discharges would apply.

As surface discharge of CBM produced water continues, the creeks and draws in the upper basin would become saturated and runoff rates are likely to increase, thus producing more water during storms. High seasonal flows during the spring would be expected to rise with the addition of CBM produced water. Channels may be more likely to overbank during snowmelt, flooding nearby fields. Localized erosion and formation of gullies, water-damaged structures, inundated vegetation, siltation, or breaching of irrigation structures may result from large, late, or prolonged floods. However, numerous impoundments constructed to store CBM produced water for beneficial use also would serve as effective structures for flood control, provided facilities were sited and constructed in accordance with WDEQ, WSEO, and WOGCC requirements. Increased surface flows also could fill channels and culverts with ice during the winter, causing localized flooding. Closed basins or playas (old lakebeds) may become inundated if CBM produced water is discharged into them.

Although drainages would not be expected to flow under completely natural conditions during the life of the project, the enhanced CBM flows are not expected to alter surface drainage patterns, except as noted. Streams enhanced by large volumes of CBM produced water may begin to establish meander patterns on longer wavelengths in response to increased flows. Stream drainages would readjust to their existing natural flows at the end of the project's life.

Downcutting (stream erosion) and sediment deposition (aggradation) are natural processes that occur as stream drainages age through time. Downcutting occurs within the upper reaches of a drainage system as the stream channel becomes incised through erosion, until the slope of the stream and its velocity are reduced and further erosion is limited. Sediment is deposited within the lower, slower reaches of a stream.

Surface drainages could be degraded from erosion caused by increased surface flows, unless rates of CBM discharge and outfall locations are carefully controlled. Increased flows could cause downcutting in fluvial environments, resulting in increased channel capacity over time within the upper and middle reaches of surface drainages. Ravines or gullies are likely to develop unless outfalls are

carefully located and designed where downcutting occurs in highly erodible soils. The design should avoid surface discharge above existing headcut areas.

Sediment transported downstream from outfalls likely would be deposited in fluvial settings as stream gradients decrease within lower reaches of drainages. Wherever sediment is deposited, the channel capacity likely would decrease over time. This decrease may increase the likelihood that localized flooding may occur. A new balance between channel capacity and floodplain morphology would be established as the proposed project is implemented, and would be re-established at the end of the project's life. Where the quality of produced water and landowner preferences allow construction of stock reservoirs to store some surface flows for beneficial use, these structures likely also would serve as effective flood control measures during intense storms. These impoundments would be located in-channel or near-channel and would be designed and sited in accordance with WSEO, WDEQ, and WOGCC requirements.

Overbank deposits (produced during floods) can yield nutrient-rich and arable soils, which may enhance the agricultural uses of the affected lands. Alternatively, overbank deposits may add saline or fine-grained sediments to a floodplain, decreasing productivity and lowering infiltration rates through the addition of materials with elevated SAR values. The latter could occur in sub-watersheds that are affected by saline soils, soils developed from shales, or CBM produced water that contains elevated SAR values.

In sub-watersheds where LAD is used as a method of produced water management, surface salts left behind could reach surface drainages during prolonged storms. Winter operation of LAD systems could build up ice on the surfaces of soil during sub-freezing temperatures. Site-specific Water Management Plans submitted at the APD and POD level of analysis would be an integral part of the mitigation planning to control and monitor the potential effects from LAD.

Springs

New springs may develop in areas where infiltration of CBM produced water is recharging alluvial aquifers or Wasatch sands. Spring flow may be inhibited locally if compaction occurs during construction or production. Natural discharge from springs can be affected by a reduction in hydraulic head within the source aquifer. It is unlikely, however, that new springs would develop near properly engineered and constructed containment impoundments, provided facilities are sited and constructed in accordance with WDEQ, WSEO, and WOGCC requirements.

Water Bodies

Large reservoirs located within or downstream of the Project Area (Lake De Smet in the Clear Creek sub-watershed, Keyhole Reservoir in the Upper Belle Fourche River sub-watershed, and Angostura Reservoir in the Upper Cheyenne River sub-watershed) potentially would receive surface flows that contain CBM produced water. Loads of suspended sediment to these reservoirs are not likely to increase as a result of surface discharge of CBM produced waters. Conversely, large flushing flows from infrequent storm events would continue to be the major carriers of sediment load. As surface streams transport suspended sediment

downstream, their ability to acquire and transport additional sediment would decrease. However, these large reservoirs would serve as sediment traps so that discharges or releases from these reservoirs would not be compromised by suspended sediment loads. More than half of the smaller permitted surface water impoundments in the Project Area could also receive surface flows that contain CBM produced water.

In-channel impoundments used to manage produced water would be designed as flow-through structures and would be properly permitted by WSEO. No existing surface water right would be expected to be affected by this method of water handling. Off-channel impoundments used to manage produced water would be properly permitted by WSEO. Shallow groundwater systems and surface waters would not be expected to be affected by this method of water handling, provided facilities are designed and sited in accordance with WDEQ, WSEO, and WOGCC requirements.

CBM produced waters discharged to off-channel containment impoundments would require an NPDES permit issued by WDEQ, which would establish effluent limitations that would be protective of use by livestock and wildlife. Concentrations of salts and trace metals, particularly selenium, may become elevated in the water contained in these impoundments as evaporation occurs. Water quality could reach levels of concern for various constituents when inflow to the impoundments ceases and NPDES permit monitoring requirements no longer apply. Sediments left behind after the water evaporates may require special handling during reclamation. The quality and quantity of CBM produced water that may reach surface impoundments should be carefully monitored and addressed in management planning for each area affected by CBM development. Potential effects on surface water impoundments should be analyzed on a site-specific basis, as needed, during review of water management plans submitted at the APD or POD level of analysis. Impacts should be mitigated through application of special conditions of approval.

Infiltration rates in impoundments used to manage produced water may decline over time. CBM produced waters high in sodium may disperse the clay soil particles and decrease the permeability of soil for impoundments constructed in clayey soils, thus decreasing the rate of infiltration. Impoundments constructed in sandy soils would be less affected by increased concentrations of sodium over time, and infiltration rates would likely be maintained over the life of the impoundment. Percolation rates and characteristics of the soil beneath infiltration impoundments should be carefully monitored and addressed in water management planning for each area that would be affected by CBM development. Potential effects on infiltration impoundments should be analyzed on a site-specific basis, as needed, during review of water management plans submitted at the APD or POD level of analysis. Effects should be mitigated through application of special conditions of approval.

Surface Water Use

Produced water from CBM wells is most likely to be beneficially used for irrigation, livestock watering, wildlife, wildlife habitats, and fisheries. Produced water would be available for limited use for dust suppression on access roads to wells under WOGCC guidelines. Water discharged to surface drainages would be

available for appropriation and diversion under WSEO authorizations. Agricultural and livestock operations would thus obtain additional surface water to manage and use. Discharge and storage of CBM produced water on upland areas in the Project Area would disperse livestock and wildlife and offer the benefit of better use of forage and reduced overgrazing and erosion.

Alternative 2A

Under Alternative 2A, effects to surface drainages, springs, surface water bodies, and surface water use would be similar to those described for Alternative 1, with the exceptions noted below.

Surface drainages would be less affected by alteration in flow, erosion, and sedimentation than under Alternative 1 because of the changes in management of produced water and decreased surface discharge of CBM produced water. Surface drainages would be less likely to exhibit iron staining below designated outfalls as NPDES permit requirements for passive treatment of iron in CBM discharges would apply to those sub-watersheds where discharge would occur. Effects from surface water impoundments designed as infiltration basins may be greater than under Alternative 1 because of the larger proportion of CBM produced water managed in these impoundments. The siting guidance established by WDEQ, WSEO, and WOGCC for these impoundments would minimize the effects.

Effects from LAD would increase from Alternative 1 because of the higher proportion of LAD used for handling CBM produced water. Potential effects from LAD would occur in those sub-watersheds where the systems were not implemented under Alternative 1, specifically in the Upper Tongue River, Upper Powder River, Salt Creek, Antelope Creek, Upper Cheyenne River, and Upper Belle Fourche River sub-watersheds. The amount of water available to support beneficial use for livestock and wildlife would increase from Alternative 1 because of the smaller percentage of direct surface discharge. The amount also would rise as a result of the increase in water handling through infiltration impoundments.

Alternative 2B

Under Alternative 2B, effects to surface drainages, springs, surface water bodies, and surface water use would be similar to those described for Alternative 1, with the exceptions below.

Surface drainages would be less affected by alteration in flow, erosion, and sedimentation than under Alternative 1 because of the changes in management of produced water and decreased surface discharge of CBM produced water. Surface drainages would be less likely to exhibit iron staining below designated outfalls as NPDES permit requirements for passive treatment of iron in CBM discharges would apply to those sub-watersheds. With the exception of the Upper Belle Fourche, additional water would be available in all sub-watersheds where CBM development is proposed to support beneficial uses through implementation of some level of active treatment. Treated water would be stored in infiltration ponds and would be available to blend with additional CBM discharges before surface discharge. CBM produced water that has been treated before it is discharged to surface impoundments would have less effect on the soils beneath

trations of suspended sediment that may occur as a result of CBM development in upstream drainages. Additional water would better support adjudicated water uses downstream.

Water Use

Agricultural and livestock operations would obtain additional surface water to manage and use during the life of the project. Stock watering and irrigation likely would increase within the area of cumulative effects.

Alternative 2A

The cumulative effects on surface drainages, springs, surface water bodies, and surface water use would be similar to those described under Alternative 1, with the exceptions noted below.

Sediment loading to downstream reservoirs would be less than under Alternative 1 because of the decreased percentage of surface discharge of CBM produced water. Infiltration impoundments constructed in -channel would further minimize sediment transport downstream to the larger reservoirs. Sedimentation may increase in surface waters adjacent to infiltration impoundments, as the impoundments are reclaimed at the end of the project's life. BMPs for erosion and sediment controls would mitigate increases in sedimentation in surface drainages during reclamation of the impoundments.

Alternative 2B

The cumulative effects on surface drainages, springs, surface water bodies, and surface water use would be similar to those described under Alternative 1, with the exceptions noted below.

The number of surface impoundments that would remain at the end of the project's life would be greater than under Alternative 1 because additional impoundments would have been constructed to contain water that had been actively treated for beneficial use. Many of these impoundments may not be reclaimed, depending on the desires of the surface owners, so that increases in sedimentation in surface drainages during reclamation would be minimized. The water available for treatment and beneficial use would decline toward the end of the project life, as the rate of discharge from wells decreases over time. Ranchers and surface owners that depended on the additional water supply to support beneficial use may need to consider alternative water supplies.

Alternative 3

The cumulative effects on surface drainages, springs, surface water bodies, and surface water use would be similar to those described under Alternative 1. However, the magnitude of effects would be reduced because of the decreased volume of CBM water that would be discharged to surface drainages and surface water impoundments throughout the area of cumulative effects.

habitats serve as oases in arid environments, such as the Project Area, and draw large numbers of animal species from adjacent uplands. Species richness, as mentioned in Chapter 3, is particularly high for the wetlands and riparian areas of the sub-watersheds of the Project Area relative to the upland areas.

Roads alter the physical environment in many ways, including increased soil density, increased temperature, increased dust, changes in surface water flow, changes to surface runoff patterns, and sedimentation (Trombulak and Frissell 2000). These types of alterations caused by roads lead to greater sedimentation and increased surface water flows to wetlands and riparian areas that can change species compositions and adversely affect macroinvertebrate populations. Roads that are built within floodplains can redirect water, sediment, and nutrients between streams, wetlands, and riparian ecosystems to the detriment of water quality and ecosystem health (Trombulak and Frissell 2000). Overall, the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems (Trombulak and Frissell 2000).

Effects from Produced Water Quantity

Water that is produced during extraction of CBM would be handled differently among the alternatives, but surface discharges that reach wetlands and riparian areas would affect them. All alternatives involve the continuous (year-round) surface discharge of produced water for the duration of the project. Not all of the produced water would reach wetlands and riparian areas associated with the main stems of the various sub-watersheds because of evaporation and percolation into the soil surface. Discharge rates for all alternatives average 6.58 gpm, or almost 11 acre-feet per year per well. The amount of water produced under Alternative 1, for example, that would reach the main stems of the various sub-watersheds ranges from 0.2 cubic feet per second (145 acre-feet per year) in the Salt Creek sub-watershed to 135 cubic feet per second (98,000 acre-feet per year) in the Upper Powder River sub-watershed (Table 4-6). Some of the discharges of produced water associated with Alternative 1 make a very large contribution to, or exceed, the natural mean monthly surface water flows of certain sub-watersheds, as shown in Table 4-13 and discussed in the section on Surface Water.

Increases to surface water flows would adversely affect existing wetlands and riparian areas because of the very large increase in volume. Major effects to be expected from produced water discharges may include the following: (1) increased erosion of channels and floodplains; (2) loss of riparian streambank vegetation; (3) changes to the composition and physical structure of the vegetation community in wetlands and riparian areas; and (4) raising of shallow groundwater table in floodplains. Erosion of channels and floodplains would increase turbidity in the water column, thus adversely affecting plankton and macroinvertebrate production and growth rates (Mitsch and Gosselink 1993) that are the basis of aquatic food chains in the prairie streams of the Project Area. Increased erosion in riparian corridors leads to the increased deposition of sediments in downstream wetlands that raises biochemical oxygen demand and adversely affects wetland functioning at several trophic levels in the food web (Mitsch and Gosselink 1993).

Riparian streambank vegetation, including gallery forests of mature cottonwood trees, may be lost by bank undercutting caused by the increased surface water flows in channels. The loss of cottonwood trees and other streambank vegetation would decrease the amount of cover and food resources for wildlife within riparian corridors and increase stream water temperatures due to a reduction in shading of the stream by vegetation.

Community composition would change because of altered nutrient inputs caused by continuous, rather than seasonal water flows. Most wetland plant seeds require moist, but not flooded, conditions for germination and early seedling growth. Freshwater marshes with cyclic water levels, rather than continuous flows, produce the greatest number of plant seeds (Siegley et al. 1988). Continuous inputs of produced water would decrease the recruitment rate of new plants and alter the age structure and species composition of wetlands and riparian areas. Studies show that measures of biomass and net primary productivity are higher in wetland and riparian ecosystems that have pulsing, rather than flowing, hydroperiods. Stagnant or continuous hydroperiods, such as would be associated with the discharged produced water from the proposed project, cause measures that are lower still (Mitsch and Gosselink 1993). The temporal cycles and spatial patterns of invertebrate species and concentrations reflect the natural seasonal cycle of insect growth and emergence. These cycles are related to the cycles of vegetation growth and species abundance that depend on the normal seasonal and periodic fluctuations of the hydrology, such as summer drying and occasional droughts and floods (Voights 1976, Mitsch and Gosselink 1993).

Continuous high stream flows into wetlands and riparian areas would change the composition of species and dynamics of the food web. The shallow groundwater table would rise closer to the surface with increased and continuous stream flows augmented by produced water discharges. Vegetation in riparian areas, such as cottonwood trees, that cannot tolerate year-round inundated root zones would die and would not be replaced. Other plant species in riparian areas and wetland edges that favor inundated root zones would flourish, thus changing the plant community composition and the associated animal species. A rise in the shallow groundwater table would also influence the hydrology of wetlands by reducing or eliminating the seasonal drying periods that affect recruitment of plant species and species composition of benthic and water column invertebrates. These changes to the aquatic food web base would affect the higher trophic levels of fish and waterfowl abundance and species richness for wetlands and riparian areas.

Water handling facilities, such as on-stream impoundments, would cause similar changes to wetlands and riparian areas through alterations in volume, velocity, and timing of the stream flow. The magnitude of effects to specific sub-watersheds would depend on the size and number of facilities. On-stream impoundments would affect wetlands and riparian areas more than would impoundments located outside of the floodplain. The number and exact locations of the impoundments are not yet known, but would be established with APDs. On-stream impoundments would also cause an elevational increase in the shallow groundwater table of the associated floodplain through infiltration of the stored water and effects already described.

Produced water from CBM wells would be gathered for discharge at outfalls. Outfalls may feed into small stock reservoirs, constructed infiltration basins, or other facilities before the outflows reach surface drainages. No direct effects on wetlands and riparian areas would occur due to the containment reservoirs because they would be constructed in upland sites. Infiltration reservoirs would be constructed within floodplains or at upland sites. Infiltration reservoirs that are constructed within floodplains would affect the wetlands and riparian areas of the respective sub-watersheds, as previously described. The full extent of these direct disturbances cannot currently be quantified because the locations of the reservoirs have not been established.

No direct effects to wetlands and riparian areas would occur as a result of the creation of land application disposal sites or injection facilities. These sites would be located in upland areas away from drainages and floodplains. Water would be applied at agronomic rates at LAD sites so that there would be no runoff or infiltration of applied water that could reach surface drainages.

Discharges of produced water would decrease after the peak values (Table 4-13) are reached and would be terminated at the end of the project. Previously existing wetlands and floodplains that had expanded because of the increase in stream flows would experience vegetation dieback as the hydrology returned to normal conditions. Wildlife populations that depend on wetlands and riparian areas for food, cover, and water may decrease in abundance and wildlife species richness may be diminished. Salt scalds are accumulations of mineral salts in surface soil caused by evaporation that may appear within riparian corridors and along wetland edges. Salt scalds inhibit growth and recruitment of many wetland and upland plant species (DLWC 2000, Seelig 2000) and could perpetuate adverse saline conditions to wetlands via surface runoff of precipitation. New depressional wetlands or groundwater wetlands created by the increased stream flows during the life of the project would dry up after discharges of produced water cease and the hydrologic conditions return to normal. Associated wetland species communities could be eliminated in these locations and are not likely to be assimilated into the communities of remaining wetlands and riparian areas. Salt scalds could appear as the saline water and saline groundwater evaporates in the newly formed wetlands.

Impacts from Produced Water Quality

The water produced during extraction of CBM has been measured at 47 locations throughout the PRB for its mineral composition and other water quality parameters by the USGS (Rice et al. 2000). Details on water quality specific to the Project Area are included in the section on Surface Water Quality of Chapter 3. The USGS study reported that most concentrations of trace elements were at or below the analytical detection limits and no noticeable trends were apparent. This study and others cited in Chapter 3 indicate that the primary water quality parameters of interest regarding ecological impacts to wetlands and riparian areas from releases of produced water are salinity caused by high concentrations of sodium cation and sodicity caused by high concentrations of bicarbonate ions.

Average values are predicted for the proposed discharges of produced water in each of the sub-watersheds that would be affected by the project (Table 4-13)

and are discussed in the section on Surface Water Quality. Substantial increases in the normal levels of salinity and sodicity in the surface waters of several of the Project Area's sub-watersheds by discharges of produced water would affect the ecosystem structure and functions of wetlands and riparian areas. The salinity and sodicity measures of the produced water discharges would not be ameliorated in the sub-watersheds where minimum mean flows are less than, and mean monthly flows are similar to, the rate of discharge for produced water that would reach the streams and rivers. Plant communities have been identified as the wetland biota most sensitive to increases in concentrations of salinity in water (Hart et al. 1991). The growth, vigor, and reproductive success of plant and animal species of aquatic and semi-aquatic systems, such as wetlands and riparian areas, depend on a range of tolerance to water quality parameters, including salinity, sodicity, pH, and others (Mitsch and Gosselink 1993). Additionally, increased salinity and longer periods of soil saturation or inundation can act synergistically to the detriment of many species of riparian plants (Hart et al. 1991). Above-normal concentrations of salinity cause stress to plants that can lead to dieback and changes in species community composition. The predicted range in the concentration of salinity of the produced water discharge for the project is greater than the threshold values for effects to plants (Horpestad 2001, James and Hart 1993, Nielsen and Brock 2001), indicating that adverse effects would affect vegetation in wetlands and riparian areas in the seven sub-watersheds with predicted average concentrations of salinity in the middle or high end of the range of values (Table 4-13). However, injury to vegetation communities of wetlands and riparian areas may be avoided if the narrative water quality standards developed for the protection of agriculture are coincidentally protective of native wetlands vegetation species.

Biota of wetlands and riparian areas other than plants would also be adversely affected by increases in salinity. Benthic and water column invertebrates of wetlands are also sensitive to increases in salinity, with adverse effects appearing in some taxa at 1,000 mg/L TDS. The most sensitive of the invertebrate taxa are benthic multicellular organisms and certain insects, such as stoneflies, mayflies, caddisflies, and dragonflies (Hart et al. 1991). Waterfowl and fish depend directly these invertebrate taxa for food.

Increased sodicity in the floodplains of the main stems of the Project Area sub-watersheds would affect wetlands and riparian areas through amplified sedimentation within riparian corridors, including floodplain terraces. SARs of 13 or more may cause potentially irreversible changes to soil structure that reduce percolation of rainfall and surface water flows, restrict root growth, limit permeability of gases and moisture, and make tillage difficult (Seelig 2000, U.S. Salinity Laboratory Staff 1954). At least some of the average SARs for the affected sub-watersheds may be greater than 13, with the highest values potentially occurring in the Clear Creek and the Upper Tongue River sub-watersheds (Tables 4-7 and 4-10). The effects of increased sedimentation have been previously discussed in this section in terms of the increase in the velocity and volume of surface water flow in stream channels. Reduced percolation and the formation of an impermeable soil surface in areas of high clay content over large expanses of floodplains would increase the contribution of surface runoff to in-channel stream flows that are already high. The establishment and maintenance of riparian grasses, shrubs, and trees within the riparian corridor and in wetlands would be limited by the

degraded soil structure caused by the highly sodic discharges of produced water. Additional information on the effects of an increased sodium absorption ratio on soils, agricultural crops, and native upland vegetation can be found in the sections on Soils, Land Use, and Vegetation.

Alternatives 2A and 2B

The numbers of well pads and the miles of linear facilities, such as roads, pipelines, and power lines, that may affect wetlands and riparian areas are the same for Alternatives 1, 2A, and 2B. The effects to wetlands and riparian areas from these facilities would therefore be the same for these alternatives. Alternatives 2A and 2B would result in similar percentages and areal extent of short- and long-term direct disturbances to wetlands and riparian areas as Alternative 1, but would result in greater direct disturbances than Alternative 3. The lack of differences in direct disturbance to wetlands and riparian areas is a result of the planned avoidance of these environmentally sensitive areas. Additional details about direct disturbances are included in Chapter 2.

Most of the affected sub-watersheds, with the exception of the Upper Belle Fourche River sub-watershed, would receive more discharges of produced water to streams and rivers under Alternatives 1 and 3 than under Alternatives 2A and 2B (Table 4-3). Therefore, the effects to wetlands and riparian areas from predicted quantity and quality of produced water would be less for Alternatives 2A and 2B than for Alternatives 1 and 3.

Alternative 3

A smaller number of facilities related to the extraction of CBM in the Project Area would be constructed under Alternative 3 than for the other alternatives and, thus, the extent of effects to wetlands and riparian areas would be proportionally less. The predicted rates of discharge for produced water that would reach the main stems of the various affected sub-watersheds would be the same as for Alternative 1 (Table 2-8). The effects to wetlands and riparian areas from quantity and quality of produced water previously discussed would be the same for this alternative. Most of the affected sub-watersheds, with the exception of the Upper Belle Fourche River sub-watershed, would receive more discharges of produced water to streams and rivers under Alternatives 1 and 3 than under Alternatives 2A and 2B (Table 4-3). Therefore, the effects to wetlands and riparian areas from predicted quantity and quality of produced water previously discussed would be greater for Alternatives 1 and 3 than for Alternatives 2A and 2B.

Cumulative Effects

Implementation of the alternatives would contribute to other types of effects on wetlands and riparian areas in the Project Area. Oil and gas extraction, in general, attempts to avoid environmentally sensitive areas such as wetlands and riparian areas. However, these types of projects are on the increase in the PRB. Future projects of a similar nature would have similar levels of effects to wetlands and riparian areas within the sub-watersheds. Other types of natural resource extraction projects might have more or fewer effects to wetlands and riparian areas of

Construction Noise Impacts

Noise impacts during the construction phase would be temporary at any location and would result from vehicles and the operation of construction equipment. Based on an average noise level of 85 dBA measured at 50 feet from a typical CBM construction site, the expected noise levels at would be 85 dBA at 50 feet, 65 dBA at 100 feet, 59 dBA at 500 feet, 55 dBA at 1,500 feet, and 53 dBA at 2,000 feet from the equipment.

Levels of construction noise would fall below 55 dBA at approximately 1,500 feet from construction. Any residences within 1,500 feet of construction would experience temporary noise levels above 55 dBA during daylight hours. Nighttime noise levels would remain at existing levels because construction would not occur at night. Noise from each construction site would be relatively short term, and the individual sites would be sufficiently widespread so that elevated noise levels from each site would not overlap in time or space with other sites.

Noise during the drilling phase would also be elevated above pre-existing levels. Typically, the noise from a drilling rig is 74 dBA at 200 feet from the rig (USGS 1981). Noise emanating from drilling rigs would decrease to 60 dBA at 1,000 feet, to 57 dBA at 1,500 feet, and to 54 dBA at 2,000 feet. Any residences within 1,500 feet of a drilling rig would experience noise above 55 dBA for the 1 to 4 days anticipated to drill the natural gas wells.

Operational Noise Impacts

The highest operational noise would occur around compressor stations. Under all alternatives, two types of compressor engines would be installed. Small booster compressor engines rated at 350 horsepower would be operated to gather natural gas from wells to the larger compressor stations. A maximum of six booster compressor engines could be operated at any location. At the larger compressor stations, large reciprocating engines rated at 1,650 horsepower would be installed to facilitate transmission of natural gas to high-pressure transmission pipelines. Typically, three or six of the larger engines would be installed at any location.

Noise has been measured at typical compressor units (USGS 1981). A noise level of 77 dBA from one large compressor engine can be expected at 50 feet from a compressor building since all compressors would be installed in enclosed buildings because of the harsh Wyoming winter weather. Noise from the smaller booster compressor engines would be slightly lower or approximately 73 dBA at 50 feet.

The effect of multiple noise sources is not arithmetically additive, but rather is a logarithmic addition. The total effect of multiple collocated noise sources is characterized by the following relationship (Harris 1991):

$$L = 10 * \text{LOG} (10^{L_1/10} + 10^{L_2/10} + \dots + 10^{L_n/10})$$

where: L_1 , L_2 , ..., L_n are the source sound levels of individual collocated sources.

facilities) to undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices, prior to construction and/or operation. The U.S. Congress (through the CAA Section 116) also authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Additional site-specific air quality analysis would be performed, and additional emission control measures (including a BACT analysis and determination) may be required by the applicable air quality regulatory agencies to ensure protection of air quality.

In addition, under both FLPMA and the CAA, BLM cannot authorize any activity which does not comply with all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans. An extensive air quality impact assessment technical support document was prepared to analyze potential impacts from the development alternatives, as well as other reasonably foreseeable emission sources, and is available for review (Argonne 2002).

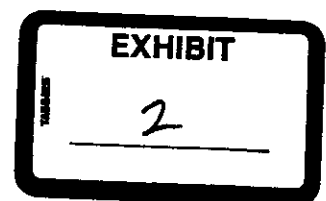
The significance criteria for potential air quality impacts include state, tribal, and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements include the NAAQS and WAAQS which set maximum limits for several air pollutants, and PSD increments which limit the incremental increase of certain air pollutants (including NO₂, PM₁₀, and SO₂) above legally defined baseline concentration levels. These legal limits were presented in Table 3-12.

Where legal limits have not been established, BLM uses the best available scientific information to identify thresholds of significant impacts. Thresholds have been identified for HAP exposure, incremental cancer risks, potential atmospheric deposition impacts to sensitive lakes, and a "just noticeable change" in potential visibility impacts.

Impacts Common to All Alternatives

Air quality impacts would occur during construction (due to potential surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including non-CBM well production equipment, booster (field) and pipeline (sales) compression engine exhausts). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils, and by air pollutant emission limitations imposed by applicable air quality regulatory agencies. Maximum construction impacts from fugitive dust (24 hour PM₁₀) are estimated to be 55 µg/m³, about one third of the applicable WAAQS. Actual air quality impacts depend on the amount, duration, location, and emission characteristics of potential emissions sources, as well as meteorological conditions (wind speed and direction, precipitation, relative humidity, etc.).

The HAP impact analysis was based on a maximum assumed six-unit reciprocating compressor engine station, applicable for all proposed Alternatives, as de-



Johnson, Thomas B NWO

From: Laurel McCoul [laurelmcoul@vcn.com]
Sent: Friday, May 14, 1999 7:07 PM
To: thomas.b.johnson@nwo02.usace.army.mil
Subject: general permit

Dear Mr. Tom Johnson,

I object to the general permit (GP 98-08) which will allow for the destruction of up to one acre of wetlands and "waters of the U.S." (lakes, ponds, rivers, streams etc.) for oil and gas development and exploration activities. While the Corps has taken the praiseworthy and important step of phasing out several destructive nationwide permits which allowed for this type of activity in the past (i.e.: NWP 26), this replacement permit must comply with the Clean Water Act and be demonstrated to incur only "minimal" adverse environmental impacts.

This permit has serious ramifications for the future of our wetlands, lakes and rivers. It will not only effect public lands, but also many private lands where oil and gas companies have leasing rights. Although the Corps has significantly altered this permit for the best since its first draft proposal, the permit still needs to be amended further to comply with the Clean Water Act and ensure the health of the environment. Unfortunately, the Corps and other federal and state resource management agencies are under tremendous political pressure right now to streamline their permitting processes to facilitate the development of oil and gas reserves throughout the state. This development will have the worst effects on local economies and ecologies, while profiting greedy industrialists in Denver, Houston, Chicago, London, etc.. We have experienced this greed first hand on our ranch south of Gillette, Wyoming. The coalbed methane gas company came to our ranch with many promises in 1996. They have broken all of their written promises (the surface owner agreement), and have failed at reclamation, controlling their water discharges, water well mitigation, maintaining all weather roads, controlling the production of coalbed methane gas, and interfering with ranch operations. Besides causing livestock injuries, deaths, and straying, these people also threaten our community with their drinking, littering, and cussing. In addition to these abuses, the coalbed methane dewatering is damaging the aquifer we depend on for domestic and livestock water. We have incurred thousands of dollars in repair costs to our water well because of this project. Damages include: gas locked pump, drop in static water level and flow rate of well, huge decrease in water quality due to the loss of the coal aquifer, explosive levels of methane found in the well water, and methane seeps beginning in the area. Because of these abuses and damages, all permits must be issued on an individual basis. Letting these carpetbaggers loose on the local ranching community is a threat to the environment as well as a threat to society.

Another particularly dangerous aspect of the coalbed methane gas development is damage to aquatic life and fish. The quality of the discharge water is too high in salts and TDS for the daphnia and other aquatic life that are the food source for fry in self sustaining fisheries. In Northeast Wyoming, we have some blue ribbon self sustaining fisheries, all of which are threatened by this project. When the daphnia die in Lake Desmet, Keyhole Reservoir, Little Goose Creek, Tongue River, Powder River, and their tributaries, the self sustaining fisheries will die with it. Such grave environmental impacts must be considered on a case by case basis, not glossed over with a general permit of any kind.

As stated above, GP 98-08 will allow for oil and gas development activities to occur in wetlands, lakes, rivers and other waterbodies throughout the state. Although there is no up to date

comprehensive information on the distribution of Wyoming's wetlands, it is known that we have lost approximately 38% of our natural wetlands and continue to lose wetlands rapidly to development and agriculture every year. According to the BLM, as many as 250 oil and gas well pads and associated structures may be constructed in or around waters of the U.S. in the Pinedale area alone! As 10 acres of wetlands are allowed to be disturbed without mitigation, this could lead to the impact of over 25 acres of wetlands in this relatively small geographic area alone. It should be kept in mind that as many as 15,000 wells have been proposed on federal lands throughout the state, not including the 10,000+ wells which may be constructed in northeast Wyoming for coal bed methane development. The environmental ramifications of this permit are devastating to this state.

*** Inadequate Protection for Springs.**

Proposed GP 98-08 prohibits construction within 100 feet of a spring. This is inadequate and should be increased to 500 feet to ensure consistency with the Bureau of Land Management's 1997 Record of Decision and Approved Management Plan for the Green River Resource Area (August, 1997). Water quality is of utmost importance for fish, wildlife and humans and should not be jeopardized.

*** Must Comply with the Clean Water Act**

No where throughout GP 98-08 does the Corps mention that all other alternatives need to be considered before allowing for development in wetlands. Under the Clean Water Act, the permit holder must attempt to avoid wetlands destruction to the greatest extent possible. Failing that, the permit holder must minimize and then mitigate for any wetlands which will be destroyed or degraded. The Corps should insert language clarifying that "sequencing" (the procedure which developers use to avoid, minimize and mitigate for wetlands loss) is not an merely an option, but an obligation as required by the Clean Water Act.

*** Potential Threats to Threatened and Endangered Species**

Proposed GP 98-08 may still pose a threat to threatened plants and wildlife. The Corps must be determined in its efforts to continue coordinating with the U.S. Fish and Wildlife Service regarding the implementation of this and other general permits. To alleviate the substantial workload which the Corps now bears, I recommend that the Corps seek greater assistance from other federal resource agencies in protecting threatened and endangered species. Such efforts will be vital during the coming months with the ongoing development of habitat conservation plans for riparian dependent species such as the Preble's Jumping Mouse and the continued preservation of other wetland dependent/associated species such as the least tern, the bald eagle, the whooping crane, the Kendall Springs dace, the Wyoming Toad, the Ute Ladies Tresses plant; potentially existing endangered species such as the Colorado squawfish, the humpback chub and the bonytail chub, and for candidate species for listing/species of concern such as the Colorado butterfly plant, the boreal toad (southern Rockies population), the spotted frog and the sturgeon chub.

*** Pad Construction**

Oil and gas exploration and development activities should not be permitted in wetlands and waters of the U.S. unless the permit holder has demonstrated that no other practical alternative can be taken.

*** Inadequate Mitigation Ratio**

When a permit holder impacts or destroys wetlands, they are often required to "mitigate" for their loss by creating or enhancing wetlands on the site, or at another location. Mitigation is a very new resource management technique and its long term effectiveness has not had the best track record. One study in Florida showed that over half of the mitigation projects in the area (the state where this technique has shown some of the most promise!) have been deemed incomplete or failures. Another study conducted in California discovered that fewer than one third of 387 wetlands were monitored even once to determine whether or not they were in compliance with environmental protections. And, although there has been no comprehensive work on the success of mitigation in the Rocky Mountain region, the U.S. Fish and Wildlife Service (Rocky Mountain Regional Office) has seriously questioned the effectiveness of mitigation and concluded that many wetlands can never be mitigated for, their values and functions diminished or destroyed forever. In short, manmade wetlands are nearly never as valuable as natural wetlands.

The Corps is asking for a replacement ratio of 2:1 for "off-site" mitigation and a replacement ratio of 1:1 for "on-site" mitigation. The off-site replacement ratio should be, at a minimum, 3:1

and the replacement ratio for on-site mitigation should be, at a minimum, 2:1. Projects should also be assessed on a "case by case" basis.

To comply with the Administration's Clean Water Initiative which calls for a "net increase of 100,000 acres of wetlands by the year 2005, and with the Informal Region VIII Guidance Concerning the February 7, 1990 EPA/Corps Mitigation Memorandum of Agreement (MOA) which calls for mitigation ratios to be shifted upward. The Corps should increase their on and off-site mitigation ratios to ensure that wetland functions and values are retained.

*** Class 1 Waters Need to Remain Protected. Special Protections Needed for Rare Wetlands Habitats and "Critical Resource Waters"**

The Corps should be commended for its resolution to disallow damaging activities in components of the National Wild and Scenic River System or in Congressionally delegated "study rivers." However, GP 98-08 must also prohibit construction in all class 1 waters of the state. Class 1 waters such as the Green River and the Snake are the "jewels" of our river system and the maintenance of their health is crucial!

In addition, the Corps should disallow degrading activities to occur in all "Critical Resource Waters" which could include: habitat for threatened and endangered species, all streams used by anadromous fish species and their associated headwater wetlands and tributaries, all wetland types that are rare and/or can not be replaced through mitigation (i.e.: high elevation bogs), all waters within three miles of National Parks or National Wildlife Refuges and source waters for drinking supplies. All high quality waters (tier 2 under Federal Water Quality standards) which fully support aquatic life deserve the strongest protection against degradation. The Corps should be encouraged to set up this "Critical Resource Water Designation" program in coordination with the U.S. Fish and Wildlife Service, the U.S. Geological Survey and other federal/state agencies and interested parties.

Values of Wetlands

Although wetlands cover only approximately 2% of the state (Dahl, T.E. 1990. Wetlands Losses in the United States 1780s to 1980s. U.S. Fish and Wildlife Service, Washington, DC), their ecological and economic values are tremendous. Wetlands are arguably the most diverse ecosystems in Wyoming. About 90% of the State's wildlife use wetlands daily (University of Wyoming, 1990) and their health is crucial for the tremendous numbers of waterfowl and other migrants using the Central Flyway. An estimated 43% of threatened and endangered

species are dependent on wetlands for survival and freshwater fish depend on wetlands either directly for food, habitat or breeding at some point in their lifecycles, or indirectly by consuming prey which are wetland dependent. Wyoming's wetlands are the key to the sustainability of many of the state's lucrative outdoor recreational activities such as hunting, fishing, rafting, backpacking and wildlife viewing. The health of the environment, especially wetlands, will be exceedingly important for Wyoming to maintain a sustainable and successful tourism industry.

Other wetland facts to consider:

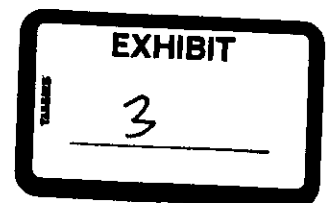
- * The United States has lost over half of its wetlands since pre-colonial times
- * Wetlands cover approximately 2% of Wyoming (Dahl, 1990), approximately 1.25 million acres. WY has lost approximately 38% of its wetlands. Wetlands cover approximately 5% of the land mass of the U.S.
- * 80% of threatened and endangered bird species rely on wetlands (USFWS)
- * one third of 1900 North American bird species use wetlands. Of those 1900, 138 are wetland dependent.
- * wetlands cleanse our water and store flood waters during periods of heavy precipitation
- * Small wetlands are valuable and should not be overlooked. For example, the Prairie Pothole region in the upper midwest- accounts for only 10% of the total duck-breeding habitat in North America, yet produces 50% of our remaining duck populations. Small wetlands scattered throughout Wyoming are of great value to waterfowl and wildlife.
- * 43% of threatened and endangered species rely on wetlands (USFWS)
- * An estimated 75% of all waterfowl breed in or around wetlands.
- * According to the American Sportfishing Association, every year sportfishing brings in an estimated \$212,421,000 to Wyoming's economy and sustains nearly 3900 jobs (Compendium of Sportfishing Statistics, American Sportfishing Association, June 1996).

For all of these reasons, no general permit of any kind should be used for oil and gas development activities.

Sincerely yours,

Laurel S. McCoul
laurelmcoul@vcn.com

[<mailto:laurelmcoul@vcn.com>](mailto:laurelmcoul@vcn.com)



Johnson, Thomas B NWO

From: RLSorenson [rnsorenson@mcn.net]
 Sent: Sunday, February 13, 2000 10:22 AM
 To: Johnson, Thomas B
 Subject: Coal Bed Methane

Hello:

I am a landowner in Northern Campbell County, Wyoming, who is impacted by the Coalbed Methane (aka CBM) development in this part of the state. The Powder River Basin is being inundated with rapid development of methane gas. The nature of methane gas development dictates that there will be a huge increase in road infrastructure, that open spaces be littered with wells and compressor stations, that large volumes of ground water be pumped onto the landscape's surface in order to free the gas for harvest by large out of state oil and gas companies.

At the present time, little or no control has been placed on the CBM developers concerning the amount of water that is being drawn from aquifers to release the gas from the coal seams. The volume of water averages 12 gallons per minute with up to 125 gallons per minute on some wells. This amounts to an average of 17,280 gallons of water per day per well. The State Oil and Gas Commission has allowed well sites to be placed at 40 acre spacing and is allowing up to three wells on each site. They expect the development to reach 30,000 wells. The State Engineer believes that pumping this water from these aquifers constitutes "beneficial use." Ranchers and people in subdivisions with private wells are seeing the result of this unprecedented draw in the reduced flow of their wells. The State Engineer denies that this amount of water being pumped from these aquifers will impact existing wells if they are not in the same coal seam. Reinjecting filtered, chlorinated water back into the aquifer has been largely disregarded by the State engineers office. Of course, the producers do not want this either, saying it is too expensive.

Another problem with CBM development, is the way in which it is being discharged onto the surface. Such gross amounts of water in this largely arid region would seem to be a blessing, but when looked at in reality, we see at least as many problems as that caused by its extraction from the ground. Much of the water being discharged on the surfaces contains metals and salts that are detrimental to growing things, and may pollute waterways. The discharge of water in such large amounts in normally dry drainages causes erosion. It creates bogs, potholes of stagnant water, weeds, washouts and other nuisances. In this region, in the heat of summer the only good grass is located in these dry drainages. Large amounts of water discharged into these areas destroys this grass and forage. Downstream landowners are often impacted by these problems, even when there is no CBM development on their lands. Again the State Engineer and the DEQ have exerted little or no pressure on CBM developers to handle discharges in any responsible way.

CBM development is resulting in disregard of the surface owners rights. These large out of state gas companies pretty much run roughshod over the private owner of the land, apparently with the blessing of the State of Wyoming. They come on property without asking permission. They often refuse to inform landowners or lessees about their plans for gas gathering or water discharge. The damage fees they offer is an insulting amount. They gouge huge areas for roads and drilling sites, much larger than is necessary. Surface property is devalued because of the encumbrances by third party easements and the damage and noise caused by CBM hardware. Neighbors' property is also devalued as a result especially in more populated areas. I was told by one well known realtor who specializes in ranch sales that he has not been able to sell one ranch with CBM development on it.

I have been informed that you will be told by state agencies and lobbyists for the CBM industry that this development is not impacting the

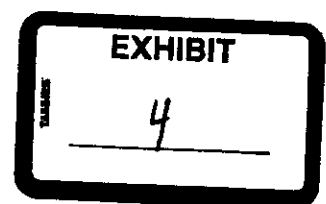
people in this area, that it is creating jobs and growth, and that everyone is happy with the results. I want you to know that that is not the case. Most of the jobs resulting from this boom have been given to out of state workers who live in motels and go home when they can. They are temporary residents and they don't care about what they do to Wyoming's land. The amount of revenue for counties and states will be far exceeded by the long term costs of this development. Folks here are concerned about the devaluation of their property. The damage to the surface from roads and drilling, ugly overhead electrical wires is far worse than anyone was ever led to believe. People here are worried about the long term effects of using water in this way. They are worried about what we are going to leave to future generations. In the historical past, much of Wyoming's water has been given to downstream states in the form of irrigation projects that benefited Wyoming very little. This is yet again another giveaway of Wyoming's water.

There are a number of things to be looked at to maintain some control of the wasteful use of water and the destruction of the surface for CBM production:

1. A moratorium needs to be passed for the withdrawal and discharge of large amounts of water for the purpose of extracting gas until a scientific model can be developed as to the long term effects on the subsurface of the land, the aquifers, and the surface.
2. Severance taxes on CBM well should be at least 7 percent or as high as the coal mine operators are paying. This would encourage operators to develop only truly profitable areas as well as enhance the state's revenues.
3. A severance tax be put on water being pumped for the purpose of extracting gas. This would benefit State revenues and also cause CBM operators to develop only truly profitable projects. In some cases only small amounts of water need to be extracted to produce gas, in others the amount is huge. If an operator could prove that the water was truly being used beneficially a reduction or credit could be made to him.
4. Written permission from impacted landowners within a one mile area to extract or discharge water, whether or not the production is taking place on their property. Landowners should be informed by the operator of how many wells they will be putting on the property, and work with the landowner as to how water is going to be used or discharged. Any documents required by the Oil and Gas Commission or the BLM should also be provided to the landowner by the operator.
5. Request that the State Engineer revise regulations concerning cross contamination of water wells or cross impact of wells between seams and aquifers.
6. Make reinjection of filtered and chlorinated water a FIRST priority in the disposal of CBM water. If operators could do this in lieu of a severance tax on water discharge, it would be cost effective for them.
7. A bond of at least \$5,000,000.00 per project be filed for the purpose of mitigating water problems as well as any other production problems. At the present time Wyoming requires a bond of only \$5000. for each producer to work anywhere in the entire state. This makes it difficult or impossible for a landowner to negotiate a fair agreement with operators, and makes it impossible to recover costs of damages done to the surface.
8. At the present time the DEQ is allowing discharge into dry drainages, of water with unacceptably high levels salts and minerals, which would not be allowed into class two or class three streams. Stop the discharge of these waters in amounts over what might normally occur in agricultural situations.

Thank you for taking the time to read this letter.

Robert and Nancy Sorenson





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 8
999 18TH STREET - SUITE 500
DENVER, CO 80202-2466

MB
TS

Ref: 8EPR-EP

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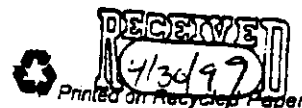
Matthew A. Bilodeau
State Supervisor
Cheyenne Regulatory Office
Corps of Engineers
2232 Dell Range Blvd., Suite 210
Cheyenne, WY 82009

RE: Wyoming General Permit 98-08 Oil and Gas
Exploration, Development, Transportation,
and Distribution Activities Application #
199820008

Dear Mr. Bilodeau:

EPA has reviewed your March 3, 1999 Public Notice concerning a Clean Water Act § 404 General Permit (GP) for Oil and Gas Exploration, Development, Transportation, and Distribution Activities within Wyoming. We understand the need for a permit of some type to replace NWP 26 as it was used for Oil and Gas development activities. However, we are concerned that the cumulative impacts resulting from the activities proposed under this GP, and the number of wells being proposed for Wyoming, may be more than minor. The draft GP does not contain any prediction of the number of individual activities projected to be regulated by the GP. The Guidelines at 40 C.F.R. 230(b)(3) require such evaluation, and it would be useful to have this information available for public comment.

The information we have from draft NEPA documents prepared by Bureau of Land Management (BLM) indicates a high potential for about 250 well pads and associated facilities to be constructed in waters of the U.S. in the Pinedale area of Wyoming alone. While we recognize that these are draft projections of future actions, the implications are clear. And proposed GP will apply to all oil and gas activities statewide, not just the Pinedale area. [We also have information from the State 402 program that 5000 or more wells could be developed in northeast Wyoming as a result of coal bed methane development. It is not clear how many could be located in waters of the U.S. but even a small fraction could result in major cumulative impacts.] As currently written the GP allows the applicant to eliminate 0.33 acres of wetlands without any mitigation requirements. If one assumes that the BLM's projections are overly conservative, and only 100 actions occurred in wetlands, this could still result in over 30 acres of impact within this relatively small area of the state. EPA is very concerned with the potential for additional cumulative impacts to waters of the U.S. as a result of this GP. In particular we are concerned that there are practicable and currently implemented BMP's and other engineering practices (e.g.



directional drilling) available to the oil and gas industry that can be used to avoid most or all impacts to waters of the U.S. while developing oil and gas resources. While these practices are apparently consistently used on federal lands, this GP does not address the potential to avoid impacts. We understand the need for stream crossings, however, we do not understand the need to site the well pad and production facilities in waters of the U.S. when less damaging, practicable alternatives may be available to the applicants.

EPA is also concerned about several of the other limitations for the proposed authorized activities. Under the road construction activity the 0.25 acre threshold seems too high. If the activity were worded to require the road to cross the stream at a right angle in order to reasonably minimize impacts, it would seem unlikely that many single road crossings in most areas of the Wyoming would have to impact 0.25 acres. Even a road 25 feet wide (which would seem very wide for the needs of an oil and gas development access road) would have to cross well over 400 linear feet of waters of the U.S. to result in a 0.25 acre impact. The GP should limit the width of the fill to the minimum necessary for the actual crossing. It would not seem that a road to provide access to a well location would need to be more than 12 foot wide. An authorization for 0.10 acre for a single crossing would still authorize a road nearly over 100 yards long. If road fills to well pads need to cross more than 100 yards of waters of the U.S., then it would seem other less damaging approaches (e.g. bridges, less damaging routes, etc) should be considered to assure that impacts are minimized. We would also point out the preamble discussion in your 1996 NWP regulations which concluded that a 200 foot road in a wetland was the maximum envisioned as minimal. Also, there should be a requirement that unnecessary roads are removed at the end of the production life of the field and stream crossings, etc., returned to their original contours and revegetated with native species.

The pad construction threshold of 500 linear feet of stream seems immaterial as it would allow construction of a square pad well over 2 acres in size. This approach seems to authorize construction of any pad in any ephemeral stream with no effort (other than the 0.33 acre maximum impact) to minimize the impacts to waters of the U.S. As indicated above, we do not believe it is necessary to construct well pads in waters of the U.S. to accomplish the project purpose, and the well pad activity should be removed from the GP.

The reservoir construction threshold of 0.50 acres also seems larger than necessary to construct a reservoir in an ephemeral drainage. At a minimum, there needs to be some understanding of the amount of water to be stored. It is our understanding that this proposed activity is primarily to accommodate reservoir construction for storage of excess water to be produced by coal bed methane production in the Powder River Basin. The production of this water, should it be released downstream, could be expected to make major alterations of the existing native aquatic communities of the area by providing greatly increased baseline discharge in the area. Many streams, and their associated native wetland communities which have adapted to the naturally arid ecosystem, will be altered from ephemeral to permanent flows in the near term. The current proposal is to allow the loss of up to 0.33 acres of existing wetlands, without mitigation, for construction of ponds. We recognize that there is potential that many ephemeral systems will receive water where water currently does not exist. However, ecologically

speaking, more water does not always mean improved wetlands. In the long term, as production ceases, the modified aquatic communities created by the constant flows will be lost, leaving reservoirs in once again ephemeral drainages. Whatever native communities had existed would likely be altered, and probably eliminated as a result of inundation. When production ceases, the reservoirs will collect the natural runoff and permanently cut off or modify the downstream hydrology. It is not clear if, or in what time frame, the inundated and downstream native communities would recover, particularly if the reservoir is left in place to further modify the native hydrology. The limitation of 1000 foot long linear inundation and 0.50 acre wetland inundation would mean a wetland greater than 20 feet wide along the stream could be inundated. In much of the arid areas of Wyoming this size of native wetland would be a significant resource particularly for streams determined to be ephemeral rather than intermittent. EPA recommends that this practice be eliminated from the GP at this time. Should it be found from experience with the program that these reservoirs cannot be constructed in uplands, or ephemeral drainages that do not contain wetlands, we will be willing to work on a modification of this GP to accommodate reservoirs that do not cumulatively result in significant adverse impacts. Another option would be to treat the impacts as temporary and require that the reservoir be removed once the gas well is closed.

The pipeline construction activity being proposed would also benefit from a requirement to cross the waters of the U.S. at right angles to the flow, as discussed above for road crossings. There is no rationale presented as to why the 50ft width of the pipeline disturbance area was selected and this seems extreme for the vast majority of pipelines associated with oil and gas development. Perhaps a separate (10 ft maximum) width should be selected for the collection systems, and if necessary, a larger width could be used for cross country transmission pipelines.

Overall, EPA agrees with the permit conditions as currently proposed. We suggest that to reduce confusion to the applicant you include a reference in the Water Quality condition that, for activities on the Wind River Reservation, the permittee will need to comply with 401 certification conditions from EPA.

One permit condition which we believe should be eliminated is the stockpiling condition. It is not clear why the construction of the authorized activities could not avoid the need to temporarily stockpile materials in waters of the U.S. If the activity is unavoidable, then weed free hay or other protective marker should be required between the wetland surface and the temporary fill to assist with removal of the fill.

In Appendix C of the GP there should be a requirement that the applicant for activities on non-federal lands with non-federal minerals will need to submit a statement of compliance on completion of the work similar to that required of applicants on federal lands. Also, a spill prevention plan should be required as part of the non-federal minerals applicant notification.


Based on the activities proposed to be authorized under this GP, the concerns expressed above, and the understanding that the process for this GP will likely result in modification of the GP in response to comments received, EPA elects to withhold 401 certification for this GP

within the exterior boundaries of the Wind River Reservation until such time as a final version of the GP is developed for review and consideration under § 401. Please continue to coordinate with Dave Ruiter of this office as further modifications are made to the GP.

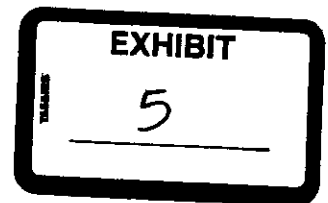
Thanks for the opportunity to comment at this time. If you have any questions on the above please give Dave a call at 303/312-6794.

Sincerely,



 James E. Luey, Ph.D., Chief
Planning and Technical Unit
Ecosystems Protection Program

cc: Mike Long, USFV/S, Cheyenne
Tom Collins, WGFD, Cheyenne
Bill DiRienzo, WDEQ, Cheyenne
Don Aragon, Arapahoe Tribe



DEPARTMENT OF THE ARMY PERMIT

Permittee GENERAL PUBLICPermit No. 199820008 (General Permit 98-08)Issuing Office OMAHA DISTRICT, CORPS OF ENGINEERS

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

General Permit (GP) 98-08 authorizes activities associated with Oil and Gas Exploration and Development in the State of Wyoming where those activities require discharges of fill material into waters of the United States, including wetlands. Authorized activities include surveys, roads, utilities, reservoirs, erosion control, and hazardous waste cleanup. See Appendix A for a detailed description of authorized activities. All activities must be accomplished in accordance with the permit general conditions and special conditions contained in Appendix B.

Prospective permittees must submit a Pre-Construction Notification (PCN) to the Corps and receive written verification of the applicability of GP 98-08 prior to undertaking any activities on non-federal land with non-federal minerals that require filling more than 0.10 acre of wetland except for hazardous waste cleanup. See Appendix C for the notification procedure.

Verification under GP 98-08 can be obtained from the U.S. Bureau of Land Management (BLM) or the U.S. Forest Service (FS) for all projects located on federal land or land with federal minerals without prior notification of the Corps. However, the permittee must submit a Statement of Compliance to the Corps within 30 days after completion of authorized activities that are approved by the BLM or FS and for hazardous waste cleanup projects. See Appendix D for compliance procedure.

Project Location:

Waters of the United States in Wyoming.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on June 30, 2005. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.
2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.
3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

See Appendix B

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

() Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

() Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

- e. Damage claims associated with any future modification, suspension, or revocation of this permit.
- 4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.
- 5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:
 - a. You fail to comply with the terms and conditions of this permit.
 - b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).
 - c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE)

(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

MARK E. TILLOTSON

(DISTRICT ENGINEER)
COLONEL, CORPS OF ENGINEERS

6/24/00

BY: *Paul R. Wemhoener* (DATE)
PAUL R. WEMHOENER, P.E., CHIEF
OPERATIONS DIVISION

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEE)

(DATE)

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX A

AUTHORIZED ACTIVITIES

The following activities qualify for authorization under GP 98-08. Each activity may be implemented individually or in combination with another activity. All authorized activities must comply with conditions listed in Appendix B.

1. **Surveys:** The purpose of these activities is to gather relevant information about an area prior to development. Surveying activities include core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, soil survey and sampling, and historic resources surveys. Plugging of test wells for oil and gas explorations may also be necessary. The width of all surface disturbance in wetland areas is limited to 30 feet and all disturbed areas must be restored to pre-project conditions. Restoration includes reestablishing natural ground contours and replacement of wetland soil in disturbed wetland areas. No permanent above ground fills are authorized. The discharge of drilling mud and cuttings may require a separate permit under Section 402 of the Clean Water Act.
2. **Roads:** The purpose of this activity is to provide either temporary or permanent access to a well location. Road crossings of waters of the U.S. must be culverted, bridged, or otherwise designed to allow passage of expected high flows. Crossings that are designed to function as fords are acceptable. A single road crossing cannot fill more than 0.10 acre of waters of the U.S., including wetlands, and the cumulative wetland area filled for a single road project cannot exceed 0.30 acre for all fills both temporary and permanent.
3. **Pads:** The purpose of this activity is to create a suitable platform for well drilling and production facilities. A single pad cannot fill more than 0.30 acre of wetland for all fills both temporary and permanent. Pads are not authorized in open water areas, including perennial stream channels. However, construction of pads may require relocation of small stream channels to accommodate the pad. Stream channel alterations are authorized on ephemeral streams only and a single pad cannot relocate more than 300 linear feet of a stream. All stream channels that are filled must be replaced by constructed stream channels that conform to the geometry of the natural stream channel and provide a continuous channel section that has at least the same length as the channel section filled.
4. **Utilities:** The purpose of these activities is to link wells with utilities such as electrical power, telecommunications, and pipelines that transport oil and gas products to storage and processing facilities or pipelines that transport produced water. Pipelines include local gathering systems and main transmission lines as well as intake and outfall structures. Construction of pipelines may include temporary fills for access roads and cofferdams. For linear projects (including temporary roads and cofferdams), the width of all surface disturbance in wetland areas is limited to 30 feet and all disturbed areas must be restored to pre-project conditions. Restoration includes reestablishing natural ground contours and replacement of wetland soil in the upper 12 inches of the trench and in all disturbed areas. Temporary sidelaying of excavated material for less than 90 days is authorized but no permanent above ground fills are authorized except for intake and outfall structures. The volume of fill for those structures is limited to 30 cubic yards. Pipeline projects must also be designed to prevent the trench and bedding material from acting as a sub-surface drain in wetlands. It may be necessary to install ditch plugs or collars to prevent drainage. Directional drilling at stream crossings is encouraged and may be required in some cases to avoid other adverse environmental consequences.

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX A

AUTHORIZED ACTIVITIES (continued)

5. **Reservoirs:** The purpose of this activity is to construct new earthen dams or rehabilitate existing dams to impound water produced by Coal Bed Methane wells. Construction of reservoirs for containing petroleum products other than produced water is not authorized. However, produced water may contain minor amounts of petroleum products provided the reservoir complies with Wyoming Water Quality Rules and Regulations, Chapter 1, Section 29, concerning oil and grease accumulation. Dams cannot exceed 20 feet in height and cannot fill more than 0.30 acre of wetland.
6. **Erosion Control:** The purpose of these activities is to construct structures to prevent erosion of stream channels due to discharges of water produced by Coal Bed Methane wells. Erosion control structures include revetments, stream barbs, and various grade control structures. The volume of fill cannot exceed 1 cubic yard per linear foot for revetments and 30 cubic yards per structure for stream barbs and grade control structures.
7. **Hazardous Waste Cleanup:** The purpose of these activities is to effect the containment, stabilization or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority. Court ordered remedial action plans or related settlements are also authorized. Containment and cleanup activities may include temporary berms, pits, or ditches to control spills as well as temporary access roads and pipelines. The establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste is not authorized. Authorization under Section 404 of the Clean Water Act is not required for activities undertaken entirely on a CERCLA site by authority of CERCLA as approved or required by the U.S. Environmental Protection Agency.
8. **Mitigation.** The purpose of this activity is to replace wetlands and other waters adversely effected by construction of other authorized activities. Most forms of compensatory mitigation do not require additional authorization, such as wetland creation in upland areas. However, there are situations where construction of a mitigation area requires filling existing waters of the U.S., such as expansion of an existing wetland or reservoir. Wetland mitigation activities cannot fill more than 0.10 acre of wetland at each mitigation site and all wetland areas filled must also be included in the mitigation requirement.

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX B

SPECIAL CONDITIONS

1. **Notification:** For projects on non-federal land with non-federal minerals, the prospective permittee or a designated agent for the permittee must notify the U.S. Army Corps of Engineers (Corps) with a Pre-Construction Notification (PCN) in accordance with the Notification Procedure described in Appendix C. A PCN is required prior to initiating any project that includes activities subject to regulation under Section 404 of the Clean Water Act which requires filling more than 0.10 acre of wetland except for hazardous waste cleanup. The permittee shall not undertake any such activities unless and until the Corps provides written confirmation that the project is authorized under GP 98-08. The Corps may determine that a standard (individual) Department of the Army permit is required in accordance with 33 CFR 325.2(e)(2). Prospective permittees can obtain authorization under GP 98-08 from the U.S. Bureau of Land Management (BLM) or U.S. Forest Service (FS) for all projects located on federal land or land with federal minerals without prior notification of the Corps. However, the notification requirement described above would apply in those areas if the BLM or FS declines.

2. **Compliance Certification:** For projects that are authorized by the BLM or FS and for hazardous waste cleanup projects, the permittee must submit a Statement of Compliance to the Corps within 30 days after completion of authorized activities as described in Appendix D.

3. **Water Quality:** The permittee must comply with all conditions issued in accordance with water quality certifications under Section 401 of the Clean Water Act (see 33 CFR Part 330.4(c)). The Wyoming Department of Environmental Quality (WDEQ) issued water quality certification with conditions for all activities in the State of Wyoming except for Tribal lands located on the Wind River Indian Reservation. A copy of the WDEQ's certification letter is attached. Please note that the WDEQ has not approved the use of GP 98-08 in Class 1 waters and waters requiring a TMDL in Tables A and C of the 303(d) list. A listing of those waters is included in the WDEQ's certification letter. However, the 303(d) list is subject to change and permittees should contact the WDEQ to obtain the most recent list. Individual certification from the WDEQ is required prior to undertaking any activities in those waters.

The U.S. Environmental Protection Agency (EPA) has issued water quality certification with conditions for all activities located on Tribal lands within the boundaries of the Wind River Indian Reservation. A copy of the EPA's certification letter is also attached.

4. **Best Management Practices:** Permittees are required to conduct authorized activities according to the following guidelines in order to avoid and minimize adverse effects on water quality and the aquatic environment.

- (a) Control the storage and disposal of petroleum products, chemicals, or other deleterious materials in such a way that it cannot enter waters of the U.S., including wetlands;
- (b) Control all construction debris, fill, and other materials disposed on upland in such a way that it cannot enter waters of the U.S., including wetlands;
- (c) Undertake all work in such a manner so as to limit increases in suspended solids and turbidity;
- (d) Limit the clearing of vegetation to that which is absolutely necessary for construction;
- (e) Maintain appropriate erosion and siltation controls in effective operating condition during construction, stabilize all exposed soil and any disturbed areas at the earliest practicable date; and
- (e) Advise downstream water users of any adverse water quality changes caused by construction.

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX B

SPECIAL CONDITIONS (continued)

5. **Suitable Fill Material:** No discharge may consist of unsuitable materials (e.g., trash, debris, car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts as required by Section 307 of the Clean Water Act.
6. **Stockpiling:** Storage of excess soil or unwanted vegetation in waters of the U.S., including wetlands, outside of approved areas is not authorized.
7. **Scrub-Shrub and Forested Wetlands:** No activity is authorized that would impact more than 0.10 acre of scrub-shrub and forested wetland combined as identified under the Cowardin classification system. Any areas identified on a National Wetland Inventory map with a "PSS" or "PFO" classification are likely to be scrub-shrub or forested wetlands.
8. **Organic Soils:** No activity is authorized that would impact more than 0.10 acre in wetland areas with organic soils that have at least 8 inches of peat at the surface (Histic epipedon) and in some cases more than 16 inches of peat (Histosols).
9. **Springs:** No activity is authorized within 100 feet of the source in natural spring areas. For purposes of this condition, a spring source is defined as any location where there is natural artesian flow emanating from a distinct point at any time during the growing season. Springs do not include seeps and other groundwater discharge areas where there is no distinct point source.
10. **Wetland Mitigation:** All projects must be designed to avoid wetlands and minimize adverse effects on wetlands that cannot be avoided. Wetlands that are temporarily filled (less than 90 days) must be restored. Restoration includes reestablishing natural ground contours and replacement of wetland soil in disturbed wetland areas. Wherever possible fill should be removed from wetlands if it is not absolutely necessary, such as reducing the size of a well pad after the drilling operation is complete. Projects that permanently fill more than 0.25 acre of wetland for all activities combined must be designed to restore or create similar wetland (in-kind) elsewhere, preferably near the project area (on-site), at a minimum replacement ratio of 1:1 for all wetland areas that are permanently filled. This mitigation requirement does supersede or prevent any other federal, state, or local agency with jurisdiction over the project from imposing additional mitigation and on some projects a lower threshold and higher ratios may be required. Construction of the mitigation area must be concurrent with construction of the project and must be completed when the project is completed. Mitigation must be successful based upon plant species and composition. There must be at least 60 percent plant coverage over the entire mitigation area with a dominance of hydrophytic plant species within 3 years after construction. Annual monitoring reports may be required to document mitigation results. If mitigation is unsuccessful, the permittee will be required to mitigate the project's wetland impacts by implementing another method to be approved by the Corps and other federal agencies, if applicable.
11. **Historic Properties:** No activity is authorized that would adversely affect sites included in the most current listing of the National Register of Historic Places or sites known to be eligible for such listing, sites included in the National Register of Natural Landmarks, or any other known historic, cultural, or archaeological sites.

PERMITTEE: General Public
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APPENDIX B

SPECIAL CONDITIONS (continued)

12. **Threatened and Endangered Species:** No activity is authorized that is likely to jeopardize the continued existence of species, or critical habitats, designated or proposed for designation as threatened or endangered pursuant to the Endangered Species Act of 1972. Therefore, prospective permittees must notify the Corps prior to undertaking any activities on non-federal lands with non-federal minerals in the following areas:
- a. Perennial and ephemeral streams and associated wetlands between 4,000 and 7,000 feet mean sea level (msl) in Converse, Goshen, Laramie, Platte, and Niobrara Counties and in the Green River basin.
 - b. Within 0.5 miles of and including the Hutton Lake and Mortenson Lake National Wildlife Refuges and all sections in Township 15 North, Range 75 West, Albany County.
 - c. Wetland areas located in a floodplain below 8,100 feet msl within the North Platte River, South Platte River, and Lodgepole Creek Basins east of the crest of the Laramie Mountains in Albany, Converse, Goshen, Laramie, and Platte Counties.
 - d. Areas within 1 mile of an active bald eagle nest site.
 - e. Riparian wetland areas from 6,000 to 11,000 feet msl in the Medicine Bow Mountains, Wind River Range, Gros Ventre Range, Absaroka Range, and Bighorn Mountains.
 - f. All of northwestern Wyoming west of U.S. Highways 120 and 789; and north of the 9th Standard Parallel North, excluding the Wind River Indian Reservation.
 - g. All areas in the Platte River and Green River basins when the activity would cause new water depletions or allow the continuation of historic water depletions. Water depletions include changes in timing of flows, evaporative losses, and consumptive uses.
13. **Wild and Scenic Rivers:** No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless, the appropriate federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service).
14. **Tribal Rights:** No activity is authorized that would impair reserved Tribal rights; including, but not limited to, mineral, water, fishing, and hunting rights.
15. **Spawning Areas and Aquatic Life Movement:** No activities are allowed in active spawning areas during the spawning season of fish and other aquatic life indigenous to the waterbody and no activity may substantially disrupt the movement of species indigenous to the waterbody, including migratory species, unless the activities purpose is to impound water. General spawning seasons for the most common fish species in Wyoming are listed below:
- | | |
|-----------------------------|------------------------------------|
| Rainbow and Cutthroat Trout | - March 15 through July 31 |
| Brown and Brook Trout | - September 15 through November 30 |
- Permittees are encouraged to obtain site specific information on active spawning areas from Fisheries Supervisors in the Wyoming Game and Fish Department's Regional Offices.

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX C

PRE-CONSTRUCTION NOTIFICATION

For projects located on non-federal lands with non-federal minerals, the producer (applicant) or a designated agent for the applicant must notify the U.S. Army Corps of Engineers with a Pre-Construction Notification (PCN) as early as possible and prior to initiating any activities under General Permit (GP) 98-08 that would require filling more than 0.10 acre of wetland except for containment and cleanup of hazardous waste. All PCN's must be in writing and must include project specific information as described in Items 1-6 below. The standard permit application form (Form ENG 4345) may be used for the notification, but must clearly indicate that it is a PCN for GP 98-08.

1. Name, mailing address, contact person, and telephone number(s) of the applicant.
2. Names, mailing addresses, and telephone number(s) of adjacent property owners (neighbors) and a statement that they have been notified in advance and given an opportunity to comment on projects that include a reservoir.
3. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
4. Brief project description including the well name and information on all activities to be authorized.
5. Project drawings with appropriate dimensions of lengths and areas for all activities to be authorized.
6. Wetland delineation for the entire project area. Delineations must be prepared in accordance with Corps Wetland Delineation Manual dated January 1987. A PCN is not considered to be complete until the Corps receives an acceptable wetland delineation. The applicant may hire a qualified consultant to complete a delineation and a list of consultants is available.
7. Mitigation plan for all projects that would permanently impact more than 0.25 acre of wetland. The plan must include a complete description of soil and water manipulation techniques, revegetation techniques, plan view and cross-sectional drawings, and a map that shows the mitigation area location.
8. Photographs of the project area and proposed mitigation area.

All Pre-Construction Notification's must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Questions concerning PCN procedure should be directed to the Wyoming Regulatory Office at the above address or by telephone at (307) 772-2300.

PERMITTEE: General Public
DA PERMIT NO.: 199820008

APPENDIX D

STATEMENT OF COMPLIANCE

For projects verified by the U.S. Bureau of Land Management (BLM) or U.S. Forest Service (FS) under General Permit (GP) 98-08 or for hazardous waste cleanup projects, the permittee must submit the following information as a Statement of Compliance for projects that require filling more than 0.10 acre of wetland. The purpose is to document activities authorized under GP 98-08. The permittee must submit the information requested below within 30 days after completion of authorized activities.

1. Full name, mailing address, contact person, and telephone number of the permittee.
2. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
3. Brief project description including the well name and information on all authorized activities.
4. Project drawings with appropriate dimensions of lengths and areas for all authorized activities.
5. Date construction began.
6. Date construction was completed.
7. The following information must be obtained from the BLM or FS Environmental Assessment for road crossings, pads, and reservoirs:
 - a. Name, mailing address, and telephone number of the BLM or FS office that issued the verification.
 - b. Area of wetland filled for each activity.
 - c. Length of stream channel filled if applicable.
8. Description of mitigation strategy for projects that permanently impact more than 0.25 acre of wetland, including a map showing the mitigation area location.
9. Date mitigation was completed.
10. Photographs of the project area and mitigation area.
11. The following statement:

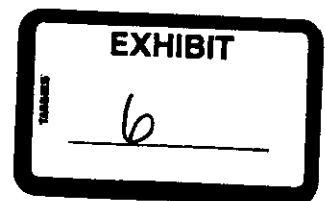
I hereby certify that the activities described above were completed in accordance with the terms and conditions of GP 98-08 and that all mitigation required as a condition of the permit was completed in accordance with appropriate mitigation guidelines. I understand that authorized activities are subject to inspection by a U.S. Army Corps of Engineers representative and that failure to comply with the terms and conditions of the permit could result in permit suspension, modification, or revocation.

Signature of Permittee

All Statements of Compliance must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

578A



**COMBINED DECISION DOCUMENT
FOR
GENERAL PERMIT 98-08**

**A PERMIT TO AUTHORIZE OIL AND GAS EXPLORATION
AND DEVELOPMENT IN THE STATE OF WYOMING**

**IN ACCORDANCE WITH
SECTION 404 OF THE CLEAN WATER ACT**

Prepared by

U.S. Army Corps of Engineers
Wyoming Regulatory Office

Approved by

U.S. Army Corps of Engineers
Omaha District

June 2000

EXECUTIVE SUMMARY

This document constitutes the review and compliance determination for issuance of a General Permit for Oil and Gas Exploration and Development projects in the State of Wyoming that include activities which require authorization under Section 404 of the Clean Water Act of 1972. The review was conducted in accordance with procedures described at 33 CFR Parts 320 and 325, including Appendices B and C, and cites the appropriate regulations for ease of reference. This document addresses the requirements contained in the Environmental Protection Agency's 404(b)(1) Guidelines published at 40 CFR Part 230. This document also serves as an Environmental Assessment and Statement of Findings in accordance with the National Environmental Policy Act of 1969.

General Permit (GP) 98-08 will be used to authorize activities necessary for exploration and development of oil and gas resources in Wyoming that have minor impacts both individually and cumulatively. GP 98-08 limits the filled area to 0.30 acre per activity with a notification threshold of 0.10 acre and mandatory mitigation for all projects that require filling more than 0.25 acre of wetland. Authorized activities include surveys, roads, pads, utilities, reservoirs, erosion control, and hazardous waste cleanup.

GP 98-08 is programmatic as defined at 33 CFR Part 325.5 (c)(3) because it allows other federal agencies that regulate the oil and gas industry, such as the U.S. Bureau of Land Management and U.S. Forest Service, to make decisions regarding the applicability of GP 98-08 and to advise applicants accordingly without prior approval by the Corps. Permittees are required to submit a Statement of Compliance to the Corps to document the use of GP 98-08 and the nature of authorized activities.

The analysis indicates that approximately 3,500 acres of wetland has been effected by past oil and gas exploration and development activities which is approximately 0.2 percent of the total wetland area in Wyoming. Issuance of GP 98-08 could result in temporary disturbance of 37 acres and filling of 73 acres of wetland per year on average if 1,152 oil wells, 2,042 gas wells, and 34,560 CBM wells are completed in the next 5 years and if GP 98-08 is used for all authorizations. However, wetland mitigation will be required to compensate for all temporary effects and approximately 90 percent of the filled areas. Therefore, a net loss of 7 acres per year is anticipated. In order to confirm these predictions, the Corps will begin to monitor actual wetland effects associated with oil and gas exploration and development by using GP 98-08 exclusively and by conditioning the use of GP 98-08 to require accurate reporting for all authorized activities.

It has been determined that issuance of GP 98-08 is not contrary to the public interest after full consideration of all public comments, relevant public interest factors, and related laws. The issuance of GP 98-08 complies with the 404(b)(1) guidelines. The issuance of GP 98-08 will not have a significant impact on the quality of the human environment and an Environmental Impact Statement is not required.

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APPENDIX A - PUBLIC NOTICE

APPENDIX B - COMMENT LETTERS

Chapter 1

General Information (33 CFR Part 325.2)

1.1 Applicant:

If issued, General Permit (GP) 98-08 (Application No. 199820008) would be available for use by all entities that are involved with exploration and development of oil and gas resources, collectively referred to as the general public. GP 98-08 would be programmatic as defined at 33 CFR Part 325.5 (c)(3) because it allows other federal agencies that regulate the oil and gas industry, such as the U.S. Bureau of Land Management and U.S. Forest Service, to make decisions regarding the applicability of GP 98-08 and to advise applicants accordingly without prior approval by the Corps. Permittees would be required to submit a Statement of Compliance to the Corps to document the use of GP 98-08 and the nature of authorized activities.

1.2 Description:

GP 98-08 could be used to authorize activities necessary for exploration and development (including transportation and distribution) of oil and gas resources. A single project has been defined as a single well or single transmission pipeline and may include several activities. Such activities include surveys, roads, pads, utilities (including pipelines and cofferdams), reservoirs, erosion control, and hazardous waste cleanup. A more detailed description of the proposed activities is contained in the public notices in Appendix A.

1.3 Purpose:

1.3.1 Basic Project Purpose - Oil and gas production.

1.3.2 Overall Project Purpose - Exploration and development of oil and gas resources in the State of Wyoming.

1.3.3 Water Dependency - Not Applicable, see Chapter 4 part 4.1.

Chapter 2

Public Notice (33 CFR Part 325.3)

2.1 Public Notice Issuance:

The initial 30-day public notice was issued on 3 March 1999. In response to requests from the Wyoming Outdoor Council, Greater Yellowstone Coalition, and the Wyoming Petroleum Association another 30-day public notice was issued 15 April 1999. The second public notice contained proposed revisions to further limit the allowable wetland impacts and add additional activities. Copies of the public notices are contained in Appendix A.

2.2 Summary of Comments:

All comment letters received in response to both Public Notices are contained in Appendix B. We received 5 comment letters from federal agencies, 1 from state agencies, none from local agencies, 11 from organizations, and 28 from individuals, including 19 by electronic mail (e-mail). A total of 45 comment letters were received. Some comment letters were received after the comment period but are also included in this summary. This paragraph is a listing of commentors, date comments were received, and a summary of relevant comments. A summary of all significant issues that were considered in the evaluation are listed in part 2.4 and a summary of other relevant comments are listed in part 2.5.

2.2.1 Federal Agencies:

(1) U.S. Environmental Protection Agency (EPA), Region VIII, 30 April 1999 & 17 May 1999. The EPA expressed concerns about construction of well pads and reservoirs in waters of the U.S., especially wetlands. The EPA believes that there would never be a need to locate those facilities in waters of the U.S. The EPA also believes that allowable wetland impacts for road and pipeline construction are too high, especially in light of projected cumulative impacts in the Powder River Basin and areas such as the Pinedale Anticline. Finally, the EPA is concerned about the lack of a mitigation requirement for activities that impact less than 0.33 acre of wetland, also due to cumulative impacts.

In its second letter the EPA supported the proposed reduction of allowable impacts and more stringent mitigation requirements. The EPA is still opposed to construction of reservoirs and other facilities in waters of the U.S. and the definition of "temporary" impacts because it could be argued that all wells are temporary. EPA recommended that industry develop a mitigation bank and that restoration be required once the useful life of the development has been attained.

(2) U.S. Forest Service, Shoshone National Forest (SNF), 16 March 1999. The SNF is concerned about permit limitations that appear to contradict its own restrictions in regard to wetlands and floodplains. Therefore, activities could result in more impact than what would be allowed by SNF.

(3) U.S. Bureau of Land Management (BLM), 12 April 1999. The BLM endorsed the permit as proposed and is willing to provide assistance in its implementation provided it does not become a "burdensome" workload for the BLM.

(4) U.S. Fish and Wildlife Service (FWS), 14 May 1999. In general, the FWS is opposed to issuance of GP 98-08 because of potentially significant cumulative impacts and because the FWS believes that the proposed activities are not similar in nature. The FWS criticized several aspects of the proposed permit criteria such as construction of reservoirs that contain oil, lack of notification below 0.33 acre, inadequate mitigation requirements, and potentially negative effects on threatened and endangered species. The FWS suggested that we complete formal consultation prior to issuance of GP 98-08.

(5) U.S.D.A. Natural Resources Conservation Service (NRCS), Gillette Field Office, 14 May 1999. The NRCS supports issuance of GP 98-08 as proposed and suggested that clarification of some terms would be helpful. The NRCS also suggested that streams with increased flows due to the discharge of produced water should be given special consideration when evaluating road crossings (i.e. allow more than 0.15 acre).

2.2.2 State Agencies:

(1) Wyoming Game and Fish Department (WGFD), 2 April 1999 and 18 May 1999. In its first comment letter, the WGFD stated that it has no concerns with the permit as proposed. However, in its second comment letter the WGFD expressed concern about construction of reservoirs on any stream type unless it is approved by the WGFD. The WGFD also expressed concerns about cumulative impacts and the appearance of no limit on "temporary" impacts.

2.2.3 Local Agencies: None

2.2.4 Organizations:

(1) Permits West, Inc. (PWI), 22 March 1999. PWI is mostly in favor of the permit as proposed. Clarifications of the definition for ephemeral streams, determinations of "no significant adverse effect" on historic properties, restrictions on springs, and stockpiling was requested. PWI recommended the addition of seismic activities.

(2) Western Gas Resources, Inc. (WGRI), 25 March 1999. WGRI is in favor of the permit, especially the programmatic aspect of the permit. Clarification that pipelines will not require permitting under both Nationwide Permit 12 and GP 98-08 was requested.

(3) Wyoming Outdoor Council (WOC), 31 March 1999, 14 May 1999, & 16 June 1999. The WOC expressed a number of concerns and is essentially opposed to the issuance of GP 98-08 in any form. Most of the concerns regard the procedure the Corps used to "issue" the permit such as;

- (a) lack of an environmental analysis in accordance with the National Environmental Policy Act (NEPA).
- (b) failure to prove that only "minimal" impacts would be authorized as required by Section 404(e) of the Clean Water Act.
- (c) failure to comply with Antidegradation Standards as defined at 40 CFR Part 131.12 and implemented by the State of Wyoming with emphasis on Class 1 waters.
- (d) failure to define Critical Resource Waters such as habitat for threatened and endangered species, all streams used by salmonids, all Tier 2 waters, all rare wetlands, all waters within three miles of a National Refuge or Park, and all waters that are used for public drinking water, including wetlands that recharge aquifers.
- (e) failure to comply with the Endangered Species Act.
- (f) failure to comply with the 404(b)(1) guidelines, including the lack of adequate mitigation.

The WOC believes that workload is not a relevant factor to consider in the decision to issue a general permit. The WOC also criticized all of the proposed permit criteria for each activity, mostly in relation to the other issues listed above. The WOC criticized the lack of public participation in permit decisions and requested that all residents of the community be mailed a copy of Pre-Construction Notifications and given 30 days to comment on each activity. Finally, the WOC requested issuance of another 30-day Public Notice and an informal public meeting to be followed by publication of the Corps anti-degradation conclusions and Environmental Assessment (EA) for comments.

In its second letter, the WOC was pleased with the proposed reductions in allowable wetland impacts but reiterated many of the exact same concerns as expressed earlier. The WOC recommended a buffer of 500 feet for streams. The WOC added its own estimates of cumulative impacts based upon the proposed numbers of wells in various documents prepared by the BLM and an assumption that most of the wells would have some wetland impacts to indicate that GP 98-08 should not be used based on the potential cumulative impacts alone.

In its third letter, the WOC strongly opposed the issuance of GP 98-08 based upon non-compliance with the Clean Water Act, Executive Order 11990, Migratory Bird Treaty Act, Endangered Species Act, and excessive cumulative impacts. A copy of that letter was provided to the EPA Director, Secretary of the Army, Assistant Secretary of the Army, and the Chief of Regulatory Branch at HQUSACE.

(4) Greater Yellowstone Coalition (GYC), 31 March 1999. The GYC opposed the issuance of GP 98-08 because it is inconsistent with the Clinton Administration's commitment to protect the nation's wetlands, and because it would violate NEPA and Wyoming's antidegradation standards. The GYC requested another 30-day comment period and a public meeting followed by preparation of an EA and an evaluation required by 40 CFR Part 230(b)(3).

(5) Independent Petroleum Association of Mountain States (IPAMS), 2 April 1999. The IPAMS requested an extension of the comment period to allow more of its members an opportunity to comment and suggested that a public meeting be held.

(6) Marathon Oil Company (MOC), 17 May 1999. MOC agrees with the concept of a general permit that can be used to authorize most activities under one permit. MOC believes that the lower thresholds for impacts are too low and provided recommendations for each activity, essentially doubling the allowable impacts. MOC also recommended reducing mitigation requirements to a 1:1 ratio and only for impacts over 0.50 acre with Corps notification only above 0.50 acre and only on private lands with non-federal minerals.

(7) Rivers Alliance of Connecticut (RAC), 12 May 1999 via e-mail. The RAC is opposed to construction of reservoirs in all cases and all other facilities unless it has been demonstrated that there is no other alternative. The RAC suggests that Class 1 waters, endangered species habitat and "rare" wetlands should be off limits. The RAC also recommended a 500 foot buffer for springs.

(8) American Wildlands (AW), 12 May 1999 via e-mail. AW is opposed to issuance of GP 98-08 because it would allow the destruction of wetlands.

(9) Gene R. George & Associates, Inc. (Agent for Yates Petroleum Corporation and True Oil Company), 17 May 1999. GGAI appreciates the proposal to issue a permit specifically for oil and gas operators but requested the following clarifications;

- (a) Add a definition of wetlands and clarify language by using the word "where" when describing the need for authorization under various activities.
- (b) Add buried water-discharge pipelines, buried electrical lines and grade control structures as authorized activities.
- (c) Describe how limitations would apply to enlargement of existing reservoirs.
- (d) Allow an exception to the notification requirement for oil spill containment and cleanup activities.
- (e) Revise definition of a single and complete project regarding mitigation for inundated areas and excluding pipelines.
- (f) Allow informal wetland delineations based upon best available information such as National Wetland Inventory maps.

(10) Sierra Club (SC), Rocky Mountain Chapter (State of Colorado), 13 May 1999. The SC criticized GP 98-08 in its original form as "stupid" and the revised proposal as "defective". The SC believes that facilities can almost always be situated to avoid sensitive resources. The SC believes mitigation is inadequate and should be at least a 2:1 ratio, Class 1 waters should be protected, there should be no reservoir construction, and that endangered and threatened species be protected.

(11) Biodiversity Associates (BA), Friends of the Bow, 18 May 1999. BA provided an 18 page letter and 6 page attachment that is aimed primarily at challenging the Corps authority to issue GP 98-08 as proposed. BA presented many of the same arguments as the WOC regarding compliance with Section 404 and other laws. The main emphasis of the comments were on compliance with the 404(b)(1) guidelines and 40 CFR Part 230, especially assessment of cumulative impacts, public participation in each authorization, and mitigation requirements. BA believes that GP 98-08 should not be issued and that an Environmental Impact Statement is required before the permit can be issued.

2.2.5 Individuals:

(1) Marilyn Dinger, 7 May 1999 via e-mail. Ms. Dinger objected to several provision of GP 98-08. She suggested that we require an alternatives analysis for each project, increase mitigation ratios, restrict reservoirs, avoid Class 1 waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. Ms. Dinger also provided numerous facts and figures regarding the importance of wetlands.

(2) Don Kesselheim, 8 May 1999 via e-mail. Mr. Kesselheim reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet.

(3) Jazmyn McDonald, 8 May 1999 via e-mail. Ms. McDonald reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet.

(4) Fran Meason, 10 May 1999 via e-mail. Ms. Meason endorsed all of the comments provided by the WOC.

(5) Robert E. Rutkowski, 11 May 1999 via e-mail. Mr. Rutkowski reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. He also emphasized the importance of wetlands using facts and figures.

(6) Karen Argenti, 12 May 1999 via e-mail. Ms. Argenti suggested a minimum mitigation ratio of 1.5:1, and a prohibition for Class 1 Waters and Critical Resource Waters. She is concerned that GP 98-08 would set a national precedent that could lead to more wetland losses in the Croton Watershed in New York.

- (7) Catherine Johnson, 12 May 1999 via e-mail. Ms. Johnson reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet.
- (8) Richard A. Smith, 12 May 1999 via e-mail. Mr. Smith emphasized the need to prohibit activities in Class 1 Waters and is also concerned that GP 98-08 would set a national precedent that could lead to more wetland losses in the Rocky Mountain region.
- (9) Thomas B. Rossetter, 13 May 1999. Mr. Rossetter is opposed to construction of any oil and gas facilities, including reservoirs, in wetlands or within 100 feet of springs.
- (10) Paul Mankiewicz, 13 May 1999 via e-mail. Mr. Mankiewicz provided comments on the importance of wetlands but no specific comments on GP 98-08.
- (11) Jeff Troxel, 13 May 1999 via e-mail. Mr. Troxel reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, and avoid sensitive habitats.
- (12) Teresa McDaneld, 13 May 1999 via e-mail. Ms. McDaneld reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs and pads, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. She also emphasized the importance of wetlands.
- (13) Gail Baxter, 13 May 1999 via e-mail. Ms. Baxter emphasized the need to prohibit activities in Class 1 Waters and is also concerned that GP 98-08 would set a national precedent that could lead to more wetland losses in the Rocky Mountain Region.
- (14) Thomas Wiancko & Judith Lohrstorfer, 13 May 1999 via e-mail. Mr. Wiancko & Ms. Lohrstorfer feel strongly that oil and gas development should avoid wetlands and riparian areas altogether.
- (15) Martie J. Crone, 13 May 1999 via e-mail. Ms. Crone reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. She also emphasized the importance of wetlands.
- (16) Muriel McNeely, 14 May 1999 via e-mail. Ms. McNeely suggested that we save every possible square foot of wetland that is left.
- (17) Andrew M. Bryson, 14 May 1999 via e-mail. Mr. Bryson reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet.

(18) Laurel S. McCoul, 14 May 1999 via e-mail. Ms. McCoul provided a lengthy description of adverse environmental affects of coal bed methane development mostly related to water quantity and quality degradation due to the production and discharge of water. Ms. McCoul reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. She also emphasized the importance of wetlands using facts and figures. In closing, Ms. McCoul stated that she is opposed to the issuance of any general permit for oil and gas development activities.

(19) Michele Barlow, 14 May 1999 via e-mail. Ms. Barlow reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet.

(20) Charles Lyford, 14 May 1999 via e-mail. Mr. Lyford reiterated the need to evaluate alternatives, increase mitigation ratios, restrict reservoirs, and increase buffers around springs to 500 feet.

(21) Phillip Johnson, 14 May 1999 via e-mail. Mr. Johnson is opposed to issuance of GP 98-08 as proposed and reiterated the need to evaluate alternatives, increase mitigation ratios, and avoid Class 1 Waters.

(22) Fran Paton, 17 May 1999. Ms. Paton is opposed to any oil and gas exploration in streams, including reservoirs.

(23) Wendell Field, 17 May 1999. Mr. Field is opposed to any oil and gas exploration or development in waters of the U.S., including reservoirs.

(24) Neil and Jennifer Miller, 17 May 1999. Mr. and Ms. Miller support all of the WOC's comments and reiterated the need to increase mitigation ratios, avoid Class 1 Waters, avoid Critical Resource Waters, and increase buffers around springs to 500 feet. They also stated that no oil and gas exploration activities should be permitted in waters of the U.S. period.

(25) Martha Christensen, 18 May 1999. Ms. Christensen reiterated the need to avoid Class 1 Waters and increase buffers around springs to 500 feet.

(26) Richard D. Anderson, 12 August 1999. Mr. Anderson is opposed to issuance of GP 98-08.

(27) Carole J. Iverson, 23 August 1999. Ms. Iverson is opposed to issuance of GP 98-08.

(28) Andrew Carson and family, 12 November 1999. The Carson Family is opposed to any oil and gas development in wetlands and perennial waters.

2.3 Consideration of Comments (33 CFR Part 320.4(a)(3)):

During the comment period several potential issues were identified that relate mostly to the process through which the Corps issues general permits. Most of the issues were identified by the Wyoming Outdoor Council (WOC) and reiterated by its members. The U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service also identified issues that were very similar to some identified by the WOC. A summary of all the issues identified during the comment period is presented below. Please note that several of the issues relate to topics that are integral to any general permit evaluation and must be considered in the analysis regardless of any expressed interest in the topic by a commentor. Therefore, the reader is referred to the appropriate chapter in this document for a description of those topics when appropriate. Other comments are addressed directly in this chapter.

The following issues were identified during the comment period:

- (1) Compliance with the Section 404(b)(1) guidelines and 40 CFR Part 230.7(b) - See Chapter 4.
- (2) Compliance with Section 404(e) of the Clean Water Act and 33 CFR Part 325.2(e)(2) - See paragraph 3.1.4
- (3) Compliance with the Endangered Species Act - See paragraph 3.2.2
- (4) Compliance with the National Environmental Policy Act (NEPA) - See Chapter 3 and parts 5.4
- (5) Compliance with Executive Order 11990 - See paragraph 3.2.1
- (6) Compliance with the Migratory Bird Treaty Act - The MBTA states that it is illegal to pursue, hunt, take, capture, or kill migratory birds, which includes its nest and egg, and applies to actions that have those purposes. A Corps permit does not authorize any such purposes. Therefore, the Corps is not responsible for ensuring compliance with the MBTA prior to issuance of a permit.
- (7) Compliance with Antidegradation Standards as defined at 40 CFR Part 131.12 and implemented by the State of Wyoming. - This issue was identified due to Protection of Class 1 Waters. The WDEQ has denied the use of GP 98-08 in Class 1 waters. See paragraph 3.2.3

(8) Protection of Critical Resource Waters (CRW). - The WOC identified habitat for threatened and endangered (T&E) species, all streams used by salmonids, all Tier 2 waters, all rare wetlands, all waters within three miles of a National Refuge or Park, and all waters that are used for public drinking water, including wetlands that recharge aquifers as CRW. The WOC has defined CRWs so broadly that it would include essentially all waters in the State except possibly Class 4. However, the WOC definition has no legal basis and is not an official designation of CRWs. This analysis does take into consideration effects on T&E species, National Refuges and Parks, water supplies, and wetlands. See paragraphs 3.2.1, 3.2.2, 3.2.12, 4.6.3.1, and 4.6.4.5.

(9) Agency Conflicts - Permittees are required to comply with all applicable federal, state, tribal, and local laws. The permittee must comply with the most restrictive criteria if jurisdictions overlap even if some of the Corps permit criteria are less restrictive than restrictions that may be imposed by another entity. Authorization by the Corps does not override other agencies regulatory requirements.

(10) Notification Requirements - The threshold for notification of the Corps was reduced to include projects that effect 0.10 acre of wetland or more. Special provisions to allow immediate authorization of oil spill containment and cleanup activities was also included.

(11) Well Pads - Construction of pads was included to authorize minor encroachments on wetland areas not to allow construction of pads in flowing stream channels or entirely within wetland areas as some suggested. In fact, it is not possible to drill a conventional oil or gas well from a pad only 0.33 acre in size which by definition precludes locating the entire pad in wetlands. The permit was never intended to allow pads to be located in flowing streams but does include a provision to allow relocation of small ephemeral streams and the permit criteria has been clarified accordingly.

(12) Reservoirs - Construction of reservoirs is included primarily for collection of produced water from coal bed methane wells not for collection of oil residue and other by products from oil production. Once again, authorization by the Corps does not override other regulatory requirements. In this case, all reservoirs must comply with Chapter 1 of the WDEQ's Regulations in order to be authorized. Reservoirs can only be constructed if the WDEQ permits the discharge of produced water from a specific well into waters of the State thereby allowing it to be collected. Likewise, if produced water is allowed to be discharged by the WDEQ then it does not matter if a reservoir is constructed on perennial streams provided the impacts are minor as defined by other permit criteria. The WDEQ already takes into account the stream classification and quality of produced water in its permit review. Therefore, a restriction to allow reservoir construction on ephemeral streams only is not warranted.

- (13) Utilities - The definition of utilities was modified to include all pipelines, including water transmission lines (including intake and outfall structures), electrical, and communication lines.
- (14) Grade Control Structures - These structures are necessary in some cases to prevent erosion due to increased flows from the discharge of produced water into streams. The permit was modified to include grade control structures and bank stabilization because of water quality and other environmental benefits.
- (15) Buffers - The purpose of a buffer around springs is to protect the spring source from surface disturbance. It was included at the request of the EPA because springs often support unique plants and insects which are virtually impossible to mitigate. The EPA recommended a buffer of 100 feet which is sufficient. There is no data to support an arbitrary increase to 500 feet.
- (16) Temporary vs Permanent Impacts - A distinction between "temporary" and "permanent" impacts was presented in the context of mitigation but was interpreted by some as a means of authorizing unlimited impacts if one uses a very broad definition of temporary. In that context, all activities could be viewed as temporary which was not the intent. Therefore, the term temporary was defined as 90 days or less and only in the context of determining mitigation requirements. For instance, the portion of a well pad constructed in wetland could be removed within 90 days and no additional mitigation is required. The maximum area of impact has been redefined for each activity separately to clarify this issue such that cumulative impacts from permanent above ground fills for a single project cannot exceed 1.0 acre.
- (17) National Precedent - Issuance of a GP for any geographic area must be done in accordance with all applicable rules and regulations, including 33 CFR Part 325 and 40 CFR Part 230. Each category of activities must be evaluated in the context of its location, past history, and future needs to determine if issuance of a GP is appropriate. The issuance of a GP in an area like Wyoming does not "open the door" for similar permits to be issued in other parts of the country without going through the permit review and approval process. Therefore, no "precedent" is set.
- (18) Restrictions on all activities in waters of the U.S. - The Clean Water Act does not grant the Corps authority to issue blanket restrictions or prohibitions on specific activities or areas. The Corps only has authority to render decisions in the context of permit actions. Therefore, the Corps cannot prohibit oil and gas exploration and production activities in all or some waters of the U.S.

Chapter 3

Public Interest Review (33 CFR Part 320.3 and 320.4)

3.1 Introduction:

In order to properly evaluate public interest factors and satisfy the requirements of the National Environmental Policy Act (NEPA), alternative project designs and locations must be considered along with the no action alternative and the potential environmental effects of the various alternatives must be disclosed. The following paragraphs summarize alternatives that were considered in this evaluation:

3.1.1 No Action Alternative - No action of any kind would require cessation of all oil and gas exploration and development activities. Adverse effects on the natural environment would be greatly reduced but adverse socioeconomic effects would increase.

No action by the Corps would require no discharges of fill material in waters of the U.S. for all projects. It may be possible to avoid waters of the U.S. for production facilities but it is not possible to provide access to those facilities and transport minerals without crossing waters of the U.S. Although crossings can be constructed above ground in order to prevent discharges of fill material, it is not practicable to require that all road and pipeline crossings be constructed in a manner that prevents all discharge of fill material into waters of the U.S.

3.1.2 Alternative Designs - A detailed evaluation of alternative project designs is not possible in the context of developing a GP because there is not a specific project proposal. However, there are technological differences in project designs that can be evaluated in order to compare environmental effects. For instance, roads could be bridged instead of using culverts for stream crossings to reduce the filled area in wetlands. Pipelines could be directionally drilled at stream crossings instead of using open trenches and cofferdams to reduce turbidity. Wells can also be directionally drilled allowing multiple wells from a single pad to reduce the number of pads. Processing facilities can be consolidated to allow a central processing unit for several wells which reduces the size of well pads. Theoretically, the technological advantages described above would reduce and in some cases eliminate discharges of fill material into waters of the U.S. Unfortunately, such technological advantages are not always practicable due to excessive cost.

3.1.3 Alternative Locations - Oil and gas production occurs statewide but specific project locations cannot be identified in the context of developing a GP. However, it is possible to restrict the use of a GP in certain locations such as Class 1 Waters, Waters that require a Total Maximum Daily Load (also known as the 303(d) list), threatened and endangered species habitat, and National Wildlife Refuges in order to reduce adverse environmental effects. In addition, projects located on lands with federal minerals can be further restricted by requirements imposed by other federal agencies such as the U.S. Bureau of Land Management and U.S. Forest Service. For instance, both of those agencies have the authority to prohibit certain activities such as placement of well pads in waters of the U.S., including wetlands, on public lands. In some cases, logistical constraints such as property boundaries, including easements, and location of existing facilities eliminate practicability of alternative locations.

3.1.4 Summary - Although the analysis shows that in some cases there are alternatives that could result in less adverse effect on the aquatic environment for various activities, the Clean Water Act (CWA) does not grant the Corps authority to issue blanket restrictions or prohibitions that require such alternatives for all projects. The Corps only has authority to render decisions in the context of permit actions. Congress enacted Section 404(e) of the CWA to allow the Corps flexibility in processing permit actions using a GP in order to reduce the burden on the regulated public for any category of activities that are similar in nature and will cause only minimal adverse environmental effects both individually and cumulatively. Therefore, the purpose of this alternatives analysis is to determine what parameters are necessary to ensure that a category of similar activities would have minimal adverse environmental effects and then to impose specific limitations and conditions, including advance notification of the Corps, in order to ensure that only the least damaging alternative is authorized under a GP. Consideration of alternatives is important in defining appropriate parameters. The Corps can require a standard (individual) permit review in order to make a final decision on a specific activity if it determines that a GP is not appropriate for a specific project. The Corps also relies on other federal agencies to ensure compliance with NEPA in those instances where the agency has broader jurisdiction over land use.

3.2 Public Interest Factors:

The following paragraphs describe the potential effects, both beneficial and detrimental, of activities on various public interest factors considering the parameters that are necessary to ensure minimal adverse effects. The discussion also addresses other related laws in the context of factors to which a law is applicable.

3.2.1 Wetlands (Executive Order 11990) - Most wetlands constitute a valuable public resource by performing functions that are important to the public interest such as;

- (a) biological functions, including general habitat for foraging, nesting, spawning, rearing, and resting sites for aquatic and land based species;
- (b) water quality functions, including erosion prevention, sediment retention, and nutrient cycling;
- (c) flood flow attenuation by serving as a storage area for flood waters;
- (d) groundwater recharge and discharge that helps maintain base flows important to other aquatic resources.

Wetlands are protected from unnecessary alteration or destruction in order to maintain those functions, especially in areas that are set aside for study purposes or as sanctuaries and refuges for wildlife due to the unique nature or scarcity of wetlands in a particular area. At the present time, analytical methods are under development that assess wetland functions such as the Hydrogeomorphic Classification System and related studies but no method has yet been approved for use as a standard in permit decisions. Therefore, the Corps must continue to rely on acreage, wetland type, and landscape position as a surrogate for defining levels of adverse effect on important functions.

Executive Order (EO) 11990 was enacted on May 24, 1977 by President Carter to ensure that federal agencies consider the importance of wetlands in decision making by taking actions to minimize the destruction loss or degradation of wetlands and to preserve or enhance values of wetlands in carrying out the agencies responsibilities. However, Section 1 (b) of EO 11990 states that "This order does not apply to the issuance by Federal agencies of permits, licenses, or allocations to private parties for activities involving wetlands on non-Federal property." Therefore, EO 11990 is not directly applicable to the Corps permit decisions because there is always another federal agency acting as the lead for compliance in those cases where EO 11990 is applicable.

Although EO 11990 is not directly applicable to the Corps regulatory program, the Corps strives to comply with the intent of EO 11990 whenever possible after full consideration of other important public interest factors. In order to strike that balance, general permits are often used as a means of encouraging project proponents to minimize adverse effects on wetlands by offering a simplified permit mechanism for activities with minor effects. Permittees benefit from a more certain and less time consuming permit review by designing projects to comply with general permits and the wetland resource benefits from voluntary reductions in adverse effects even though some adverse effects do occur.

3.2.1 Wetlands (continued)

Other federal agencies such as the U.S. Bureau of Land Management have the ability to impose restrictions on surface disturbing activities in accordance with EO 11990. The BLM has adopted the "Wyoming BLM Mitigation Guidelines for Surface Disturbing and Disruptive Activities" to limit surface disturbance near wetlands and other waters by restricting most activities and establishing a buffer. The BLM's guidelines would apply to all oil and gas related activities and adverse effects on aquatic resources on lands managed by the BLM would be avoided to the maximum extent possible. The U.S. Forest Service imposes similar restrictions. Therefore, in most cases adverse effects on wetlands located on lands with federal minerals would be limited to only those activities where avoidance is not practicable such as road and pipeline crossings.

For activities on lands with private or state minerals, it has been determined that the Corps must impose criteria to limit adverse effects on wetlands for specific activities in order to ensure only minimal adverse effects would occur. After consideration of comments and other factors, the following criteria regarding wetlands was adopted;

- (a) Pads - Maximum filled area is 0.30 acre;
- (b) Roads - Maximum filled area is 0.10 acre/crossing and 0.30 acre/project;
- (c) Utility Lines - No permanent above ground fills and topography in all disturbed areas must be restored to pre-project conditions except for structures which are limited to 30 cubic yards. Linear projects limited to 30 foot width for ground disturbance and must be designed to prevent drainage;
- (d) Erosion Control Structures - Maximum volume is 30 cubic yards for grade control structures or stream barbs and 1 cubic yard per linear foot for revetments;
- (e) Reservoirs - Maximum filled area is 0.30 acre;
- (f) Surveys - No permanent above ground fills and topography in all disturbed areas must be restored to pre-project conditions;
- (g) Spill Containment and Cleanup - Activities must be directed by another agency with authority over the cleanup.

Furthermore, the maximum filled area in palustrine scrub-shrub wetlands, forested wetlands, and wetlands with organic soils are limited to 0.10 acre.

3.2.2 Fish and Wildlife, including Threatened and Endangered Species (Fish and Wildlife Coordination Act [16 U.S.C. 661-666c] & Endangered Species Act of 1972 [16 U.S.C. 1531 et seq.]) - Authorized activities could have adverse effects on terrestrial and aquatic wildlife. Wildlife would be temporarily dispersed during drilling operations and during construction of roads and utilities. After construction, roads and pipelines fracture habitat and displace wildlife. Wells and production facilities can also result in lost habitat and can cause mortality in waste pits that attract migratory birds. However, most effects on terrestrial wildlife occur in uplands outside of the permit area and are beyond the Corps control.

3.2.2 Fish and Wildlife, including Threatened and Endangered Species (continued)

Aquatic wildlife, including fish, can be directly affected by authorized activities that result in loss of habitat. Excessive loss of wetland habitat can have adverse effects on several species, especially those that are dependent on wetlands for both forage and reproduction such as waterfowl, frogs, toads, salamanders, and insects. Wetland losses due to construction of pads and road crossings are anticipated. Open water bodies such as ponds and lakes are important habitat for those same species and several fish species. However, no significant loss of open water habitat is anticipated because pads would not be located in open water areas. Free flowing streams are very important to native fish species, especially in active spawning areas. Restrictions on in-stream activities in active spawning areas would be imposed on any authorization. Mitigation wetlands should completely replace any open water habitat losses and would significantly reduce the loss of wetland habitat. In addition, some aquatic habitats would benefit from discharges of produced water from CBM wells and associated reservoirs.

Activities that are likely to jeopardize the continued existence of threatened or endangered species would not be authorized. Therefore, the Corps must evaluate all regulated activities that "may effect" listed species in areas where the Corps is the lead federal agency (i.e. non-federal lands with non-federal minerals) and consult with the U.S. Fish and Wildlife Service when necessary. In order to accomplish that requirement, prospective permittees would be required to notify the Corps prior to undertaking any activities on non-federal lands with non-federal minerals in the following geographic areas:

- a. Perennial and ephemeral streams and associated wetlands between 4,000 and 7,000 feet mean sea level (msl) in Converse, Goshen, Laramie, Platte, and Niobrara Counties and in the Green River basin.
- b. Within 0.5 miles of and including the Hutton Lake and Mortenson Lake National Wildlife Refuges and all sections in Township 15 North, Range 75 West, Albany County.
- c. Wetland areas located in a floodplain below 8,100 feet msl within the North Platte River, South Platte River, and Lodgepole Creek Basins east of the crest of the Laramie Mountains in Albany, Converse, Goshen, Laramie, and Platte Counties.
- d. Areas within 1 mile of an active bald eagle nest site.
- e. Riparian wetland areas from 6,000 to 11,000 feet msl in the Medicine Bow Mountains, Wind River Range, Gros Ventre Range, Absaroka Range, and Bighorn Mountains.
- f. All of northwestern Wyoming west of U.S. Highways 120 and 789; and north of the 9th Standard Parallel North, excluding the Wind River Indian Reservation.
- g. All areas in the Platte River and Green River basins when the activity would cause new water depletions or allow the continuation of historic water depletions. Water depletions include changes in timing of flows, evaporative losses, and consumptive uses.

3.2.3 Water Quality (Sections 401 and 402 of the Clean Water Act of 1972 [33 U.S.C. 1341]) - No adverse effects on water quality are anticipated if activities are accomplished in accordance with stipulations contained in the Wyoming Department of Environmental Quality's (WDEQ) Section 401 certification issued on 7 April 1999. The WDEQ's certification does not apply to Class 1 waters and waters that are listed on the 303(d) list that require a Total Maximum Daily Load. Activities that effect those waters would require an individual certification. The WDEQ has also added specific conditions to the certification for pipeline construction at stream crossings. The Corps considers the WDEQ's certification as the final determination relative to water quality issues as required by the regulations.

The EPA has not certified the use of GP 98-08 on the Wind River Indian Reservation and individual certification will be required for any activities on Tribal lands.

3.2.4 Historic, Cultural, Scenic, and Recreational Values (National Historic Preservation Act of 1966 [16 U.S.C. 470] & Preservation of Historical and Archaeological Data Act of 1974 [16 U.S.C. 469 et seq]) - Activities that are likely to adversely affect historic properties would not be authorized. Therefore, the Corps must evaluate all regulated activities that "may effect" historic properties. In order to accomplish that requirement, prospective permittees would be required to notify the Corps prior to undertaking any activity in those areas where the Corps is the lead federal agency. The Corps will then evaluate the proposed activity to determine if consultation with the Wyoming State Historic Preservation Office is required.

3.2.5 Limits of the Territorial Sea (Deepwater Port Act of 1974 [33 U.S.C. 1501 et seq.]) - Not Applicable

3.2.6 Consideration of Property Ownership - Property ownership was evaluated in the context of federal and non-federal lands. Federal lands are managed by other agencies for the benefit of the public and the Corps defers to those agencies on issues regarding land use. The use of some non-federal lands are also controlled by other federal agencies when they contain federal minerals and the Corps again defers to those agencies regarding the consideration of private uses of the land in connection with mineral extraction. On non-federal lands and minerals the Corps gives full consideration of the landowner's desires for land use. In those instances, oil and gas production cannot occur without the landowner's consent. Therefore, it would not be possible for the Corps to authorize a project over the objections of a private landowner with mineral rights but the Corps may impose limitations or conditions that control how and where a project is implemented which may differ from the landowner's plans for the area. The Corps may also deny the use of GP 98-08 for a project which would require a more rigorous individual permit review. In that case, a final decision on issuance of a permit is beyond the context of this evaluation. In summary, it is very unlikely that the use of GP 98-08 to authorize a project on non-federal lands with non-federal minerals would be opposed by the landowner.

3.2.7 Activities Affecting Coastal Zones (Section 307(c) of the Coastal Zone Management Act of 1972, as amended [16 U.S.C. 1456(c)] & National Fishing Enhancement Act of 1984 [PL 96-623]) - Not Applicable

3.2.8 Activities in Marine Sanctuaries (Section 302 of the Marine Sanctuaries Act of 1972, as amended [16 U.S.C. 1432] & Marine Mammal Protection Act of 1972 [16 U.S.C. 1361 et seq.]) - Not Applicable

3.2.9 Other Federal, State, or Local Requirements - Permittees are required to comply with all applicable federal, state, tribal, and local laws. The permittee must comply with the most restrictive criteria if jurisdictions overlap even if some of the Corps criteria are less restrictive than restrictions that may be imposed by another entity. Therefore, compliance with other applicable laws is anticipated.

3.2.10 Safety of Impoundment Structures - The Wyoming State Engineer's Office (WSEO) is responsible for administering State water laws, including dam safety criteria. A permit from the WSEO is required for construction of any reservoir. In addition, the Corps authorization would include restrictions on dam height of 20 feet and minimum side slopes of 2H:1V for safety reasons. Therefore, threats to public safety due to construction of dams to impound water are not anticipated.

3.2.11 Floodplain Management (E.O. 11988) - Pads, roads and reservoirs are the only authorized activities that could affect floodplain characteristics because they result in above ground fills. Pads would have the least impact because they do not confine flood flows and cover small areas. Roads are generally not constructed in a manner that would significantly alter floodplains because it is most desirable to cross streams at right angles to minimize the possibility of flooding the road rather than parallel to streams when the road could act as a levee. Reservoirs would result in the most noticeable effects on floodplains due to alteration of the timing and duration of flood flows but reservoirs are generally perceived as a benefit to other structures in the floodplain due to the flood flow attenuation. The most significant effects on floodplains would occur if a reservoir failed but the Corps defers to the WSEO in regard to safe construction of dams as described in paragraph 3.2.10 above. The Corps also defers to other federal agencies for activities on federal lands and local governments in urban areas where any alteration of the floodplain is more critical. In summary, no significant floodplain alterations are anticipated to occur in areas where the Corps is the sole regulatory agency and the Corps has the discretion to deny the use of GP 98-08 if it is determined that a particular project would have unacceptable adverse effects on floodplains.

3.2.12 Water Supply and Conservation - None of the activities that would qualify for authorization under the GP 98-08 are directly related to water use. However, coal bed methane (CBM) wells produce enormous amounts of water that is rarely used for any secondary purpose. Development of CBM wells is probably the most wasteful "use" of groundwater and is extremely controversial due to other adverse consequences such as stream erosion and flooding. The WSEO has sole jurisdiction over the appropriation of water and does recognize the production of water in connection with mineral development as a beneficial use. Therefore, the Corps has no control over the production of water and the discharge of produced water to streams as further defined in Section 101(g) of the CWA.

3.2.13 Energy Conservation and Development (Federal Power Act of 1920 [16 U.S.C. 791a et seq.] & Ocean Thermal Energy Conversion Act of 1980 [42 U.S.C. 9101 et seq.]) - Development of oil and gas resources is extremely important to the public. Oil is critical to all aspects of an industrial economy. Natural gas is the fuel of choice for heat production because it is low cost and produces the least amount of harmful by products when burned as compared to other fossil fuels. The production of CBM conserves resources when compared to the historic practice of venting gas to the atmosphere to facilitate coal mining.

3.2.14 Navigation (Section 10 of the Rivers and Harbors Act of 1899) - The only Section 10 water in Wyoming is Flaming Gorge Reservoir and no adverse effects are anticipated because no activities are likely to occur in the reservoir.

3.2.15 Other Environmental Benefits - Natural gas production can result in other environmental benefits such as the creation or enhancement of fish and wildlife habitat using produced water from CBM wells. However, benefits are expected to be limited.

3.2.16 Economics - Development of oil and gas resources would provide significant economic benefit to private companies, individuals, local governments, state government, and the federal government. The State of Wyoming received more revenue from taxes on natural gas than on any other resource, including coal, in 1998 and that trend is expected to continue due to CBM development.

3.2.17 Mitigation - Wetland creation and or restoration is important to ensure that cumulative wetland losses are minor. However, it is unreasonable for the Corps to require mitigation for all wetlands to be filled, especially on federal lands where another agency has the responsibility of controlling wetland loss under EO 11990. To ensure appropriate mitigation in accordance with the Corps and EPA MOA concerning mitigation dated 6 February 1990, the Corps requires minimization of wetland impacts where practicable and compensatory mitigation at a minimum replacement ratio of 1:1. Higher ratios may be required on an individual project basis to account for losses or reductions in important functions. The Corps may also require mitigation of adverse effects on other waters if deemed necessary.

3.2.18 Traffic and Transportation Patterns - Oil and gas development usually results in extensive road construction and can have adverse effects on local traffic patterns. The most extensive road development is likely to occur on federal land due to the large tracts of land involved and the Corps defers to the federal land management agency to control road network planning and construction on lands under its control. It is unlikely that there would be extensive road construction on non-federal lands because landowners generally prefer to limit surface disturbance to avoid conflict with livestock production and in many cases better access from existing roads is already available on smaller tracts so less new roads are required.

3.2.19 Safety - Road construction presents the greatest potential threat to public safety. The Wyoming Public Service Commission and Wyoming Transportation Commission regulate the use of appropriate warning devices and other safety measures on public roads under WSA 37-10-102(a) and (b). The Corps defers to those agencies on design and construction of safe public roads. No other activities should pose any threat to public safety if properly operated and maintained.

3.2.20 Noise - As with any construction activity, noise will increase during construction due to heavy equipment. No long term increases in noise are anticipated from gas wells and noise from pump jacks on oil wells is considered to be insignificant.

3.2.21 Air Quality (Section 176(c) of the Clean Air Act) - Oil and gas production does contribute to air pollution, usually in the form of emissions from compressor stations but also from venting unburned hydrocarbons into the air. However, many coal fired powerplants are converting to natural gas to meet stricter air emissions standards which will result in significant air quality improvements.

3.2.22 Land Use Classification (Interstate Land Sales Full Disclosure Act [15 U.S.C. 1701 et seq.]) - Not Applicable

3.2.23 Prime and Unique Farmlands - Most farmland is located on non-federal land with non-federal minerals where the landowner has full control over surface disturbance. It is anticipated that in most cases the landowner would not allow destruction of prime or unique farmland due to its high value.

3.2.24 Wild and Scenic Rivers (Section 7(a) of the Wild and Scenic Rivers Act [16 U.S.C. 1278 et seq.]) - The only wild and scenic river in Wyoming is the Clarks Fork within the Shoshone National Forest and no development in that area is anticipated due to restrictions imposed by the U.S. Forest Service.

3.2.25 Food and Fiber Production - Adverse effects on livestock grazing could occur as a result of changes in land use and water use, both of which are beyond the Corps ability to control.

3.2.26 Mineral Needs - The continued production of oil and gas resources is essential to meeting the Nation's needs for power generation, manufacturing, and transportation. However, fossil fuels are non-renewable and eventually will be exhausted in some areas.

3.3 Compliance Determination:

The Corps has reviewed and evaluated this permit action in light of the relevant public interest factors and the stated views of other interested agencies and the concerned public. In doing so, the Corps has considered the possible effects of the project in accordance with regulations published at 33 CFR Part 320. The following paragraphs summarize the results of the evaluation and how the project complies with the above cited regulations.

3.3.1 The relative extent of the Public and Private Need for the Projects (320.4(a)(2)(i)) Oil and gas production is important to both public and private interests nationwide for numerous reasons but economics is the primary consideration. The current U.S. economy could not function properly without the use of fossil fuels.

3.3.2 Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objectives of the project (320.4(a)(2)(ii)) - Alternatives have been considered in development of limitations and conditions for GP 98-08 and opportunities exist for additional review of alternatives for specific projects during the approval process. The Corps has the ability to use discretionary authority to deny the use of GP 98-08 and require a more rigorous review of alternatives under an individual permit process.

3.3.3 The extent and permanence of the beneficial and/or detrimental effects which the project is likely to have on the public and private uses to which the area is suited (320.4(a)(2)(iii)) - In general, oil and gas production can be beneficial to property ownership, energy conservation and development, economics, and mineral needs. It can be detrimental to wetlands, fish and wildlife, water quality, water supply and conservation, traffic and transportation patterns, and air quality. The factors of historic, cultural, scenic, and recreational values, safety of impoundment structures, floodplain management, and noise are relevant but have essentially neutral effects. Overall, the detrimental effects do not outweigh the beneficial effects after consideration of appropriate mitigation measures. The Corps or other federal agencies will continue to evaluate the use of GP 98-08 to ensure that authorized activities are not contrary to the public interest.

3.3.4 Cumulative Effects - Reliable information is not available to properly assess potential cumulative effects on all of the various public interest factors. The Corps will evaluate the potential effects of individual projects on the public interest as needed prior to issuing authorization. See part 4.4 for an analysis of cumulative effects on aquatic resources.

Chapter 4

Section 404(b)(1) Guidelines (40 CFR Part 230)

4.1 Introduction:

The following paragraphs contain an evaluation of proposed activities in accordance with the Guidelines and implementing regulations at 40 CFR Part 230.7 for general permit actions. Part 230.7(a) states that a general permit for a category of activities involving the discharge of dredged or fill material complies with the Guidelines if it meets the applicable restrictions on the discharge in Part 230.10 and if the permitting authority determines that:

- (1) The activities in such category are similar in nature and similar in their impact upon water quality and the aquatic environment;
- (2) The activities in such category will have only minimal adverse effects when performed separately; and
- (3) The activities in such category will have only minimal cumulative adverse effects on water quality and the aquatic environment.

Part 230.7(b) describes the evaluation process as:

- (1) This evaluation shall be based upon consideration of the prohibitions listed in 230.10(b) and the factors listed in 230.10(c), and shall include documented information supporting each factual determination in 230.11 of the Guidelines (**consideration of alternatives in 230.10(a) are not directly applicable to general permits**).
- (2) The evaluation shall include a precise description of the activities to be permitted under the general permit explaining why they are sufficiently similar in nature and in environmental impact to warrant regulation under a single general permit based on Subparts C-F of the Guidelines.
- (3) To predict cumulative effects, the evaluation shall include the number of individual discharge activities likely to be regulated under a general permit until its expiration, including repetitions of individual discharge activities at a single location.

4.2 Similar Activities and Similar Impacts (230.7(a)(1)):

The regulations allow for development of general permits for "categories" of activities not just singular activities. Therefore, the activities purpose is a more important factor to consider in determining if a category of activities is similar in nature than the physical aspects. In this case, the project purpose is narrowly defined as oil and gas production in Wyoming and the category of activities includes only those activities that support the project purpose. The fact that road crossings look different than pads and reservoirs is irrelevant. Likewise, the permit would not authorize road crossings, pads, and reservoirs for another purpose such as residential development even though physically the projects could look exactly the same.

4.2 Similar Activities and Similar Impacts (continued)

Similar impacts are a little more difficult to quantify. For instance construction of a road crossing and a dam are essentially the same except for passive versus active water control features. They can have the same effects due to ponding but for different durations. However, the effects of ponding are much different than the effects of fill. Construction of roads and well pads are nearly identical in impact and differ only in dimension. Construction of pipelines is unique because there are no above ground fills yet pipeline corridors are similar to roads due to landclearing. In order to assure similarity between activities, it was determined that consistent acreage limits on the amount of fill is the most relevant permit criteria. Therefore, all filling activities were limited to 0.30 acre.

4.3 Individual Adverse Effects (230.7(a)(2)):

Adverse effects on water quality and the aquatic environment can be defined in a number of ways depending on the particular constituent of interest. It would be nearly impossible to develop a matrix to accurately compare all of the relevant factors. However, permit conditions can be used to prevent several adverse effects from occurring in order to reduce the analysis to its most basic components. Therefore, the area of effect was used as a surrogate in the evaluation of adverse effects with an intent to define the physical parameters that constitute "minimal adverse effects" for individual activities and individual projects. Additional permit conditions were then incorporated to ensure that overall adverse effects are minimal.

The regulations define a single project as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers at 33 CFR Part 330.2(i). However, that part of the regulations also defines each crossing of a water of the U.S. as a "single and complete project" for linear projects such as roads and pipelines. Unfortunately, the regulations confuse the terms activity and project because NWP 12 and 14 can be used to authorize numerous crossings (activities) associated with a single road or pipeline which most people would perceive as a single project. It is clear that the language in the regulations was intended to demonstrate that NWPs can be used in combination to authorize several activities associated with a single project.

Perhaps the best point of reference for defining minimal impacts for general permits are the Nationwide Permits (NWP). From a national perspective, NWPs are generally accepted as the standard for minimal impacts associated with specific activities because those standards were developed based upon a nationwide public input process.

For this evaluation, NWP 6 (Survey Activities), NWP 12 (Utility Lines), NWP 14 (Road Crossings), NWP 18 (Minor Discharges), NWP 26 (Headwaters and Isolated Waters Discharges), and NWP 33 (Temporary Construction Access and Dewatering) were used as reference standards. In general, those NWPs define minor impacts for single activities based

4.3 Individual Adverse Effects (continued)

on areas ranging from 0.10 acre to 3.0 acres depending on the location and nature of the activity. However, NWP 26 allowed the highest level of impact at 3.0 acres and was revoked during this permit evaluation process due largely to cumulative impacts. Therefore, a more realistic upper limit is 0.50 acre for a single activity and 1.0 acre for a single project (assuming 2 NWPs are combined) using the new NWPs published on 7 March 2000, to replace NWP 26. In addition, none of the NWPs specifically require compensatory mitigation although avoidance and minimization is required. As a matter of current policy, compensatory mitigation is usually required for projects that result in the loss of more than 0.33 acre of wetland.

In order to ensure that potential impacts to waters of the U.S. are minimal, GP 98-08 was developed by establishing limits on both temporary and permanent impacts to waters of the U.S. that are equivalent to or more restrictive than the NWPs for a similar activity. In general, the maximum area of permanent impact for all activities is limited to 0.30 acre essentially limiting a single project to no more than 1.0 acre if all activities were combined. Advance notification is required for projects that impact more than 0.10 acre of wetland on lands where the Corps is the lead agency, and compensatory mitigation is required for all projects that result in the loss of more than 0.25 acre of wetland. Temporary impacts due to pipeline construction are limited to 30 feet in width. Projects located on lands with federal minerals are further restricted by requirements imposed by lead federal agencies such as the U.S. Bureau of Land Management and U.S. Forest Service.

4.4 Cumulative Effects (230.7(a)(3)):

Assessment of cumulative effects has gained a lot of prominence in recent years and is often the basis of criticism. Although important, cumulative impact assessments are as much an art as a science because there are no specific criteria or standards to be followed and in most cases relevant information is simply not available. Databases are most often used to summarize past cumulative effects but are usually incomplete. For future actions it is common practice to estimate potential effects based on past trends for arbitrary numbers of actions because the actual number of actions that may occur is unknown and then set a threshold based upon an "acceptable" level of adverse effect followed by monitoring to determine when the threshold has been reached. That method is consistent with Part 230.7(b) which requires a "prediction" of cumulative effects that includes the number of individual discharge activities likely to be regulated under a general permit until its expiration.

A query of the Corps database (RAMS) was attempted and would normally be used to document past cumulative effects for specific activities. Unfortunately, in this case RAMS yields poor results because there has never been a single permit mechanism to authorize oil and gas projects and it is not possible to determine how many previously permitted road crossings, utility lines, or headwater discharges are relevant. Admittedly, the Corps has done a poor job of tracking past impacts on both wetlands and other waters primarily due to a lack of notification for numerous activities and "generic" permits that do not distinguish the type of project such as Nationwide Permit (NWP) 26. In addition, wetland impacts due to construction of pipelines is not entered in RAMS because notifications that were received under NWP 12 were voluntary and wetland delineations were not required. Therefore, RAMS query results for oil and gas related activities are unreliable and were not used in this evaluation.

In order to estimate cumulative effects from past oil and gas related activities, the results from a more recent study of cumulative effects in the upper Green River basin (upstream of Fontenelle Reservoir) that was completed for the Pinedale Anticline (PA) study area was referenced. That study area covered 3,956 square miles and contains approximately 202 square miles (sm) of wetlands (5 percent). A total of 2,225 wells have been drilled in the study area and cumulative wetland impacts were estimated to be 231 acres (0.2 percent) from 17 well pads and 71 miles of road. According to the Wyoming Oil and Gas Conservation Commission (WOGCC), approximately 37,000 wells are currently registered as having been completed, including 3,201 CBM wells, but the records are incomplete. Therefore, approximately 3,500 acres of wetland may have been effected in the past due to construction of 258 well pads and 1,078 miles of roads which is about 0.2 percent of the 1.3 million acres that probably existed prior to settlement.

To predict the potential cumulative effects for future activities, data was obtained from the WOGCC on the numbers of Applications for Permits to Drill (APDs) that were approved in the past six months. The number of APDs is the best indicator of the maximum number of potential wells that could be drilled but is not necessarily the actual number that would be drilled. The data was also analyzed to determine how many potential wells have federal minerals (includes Tribal) and private minerals (includes all fee and state). CBM wells were also evaluated separately.

4.4 Cumulative Effects (continued)

The following table is a summary of the actual WOGCC data from November 1999 to April 2000:

Month	Oil Federal	Oil Private	Gas Federal	Gas Private	CBM Federal	CBM Private	Total
Nov 99	11	7	49	18	560	67	712
Dec 99	4	7	4	15	150	540	720
Jan 00	6	4	19	20	320	618	987
Feb 00	8	29	78	16	149	733	1013
Mar 00	37	11	43	20	92	761	964
Apr 00	17	13	42	12	25	263	372
Total	83	71	235	101	1296	2982	4768

The analysis shows that 4,768 wells were authorized by the WOGCC in a six month period or approximately 800 wells per month on average. There has been a dramatic increase in the number of CBM wells which account for 90 percent of the wells approved. There were 336 conventional gas (gas) wells accounting for 7 percent and 154 oil wells accounting for 3 percent. Wells with federal minerals account for 54 percent of oil wells, 70 percent of gas wells, 30 percent of CBM wells, and 34 percent of all wells.

Extrapolation of the data suggests that up to 9,600 wells could be approved per year in the near future if CBM production continues as expected. Of that amount, 288 would be oil wells, 672 would be gas wells, and 8,640 would be CBM wells. There could be 155 oil wells, 470 gas wells, and 2,600 CBM wells on federal lands and minerals.

In order to predict the potential cumulative effects on wetlands, it is necessary to have some baseline assumptions about the individual effects of different well types. Assumptions take into account tighter restrictions on federal minerals and experience from recent authorizations. The following assumptions were used to predict cumulative effects:

- a. Private oil and gas wells effect 0.15 acre of wetland on average for roads and pipelines with 2 percent of well pads encroaching on wetlands.
- b. Federal oil and gas wells effect 0.05 acre of wetland on average for roads, and pipelines with no well pads effecting wetlands.

4.4 Cumulative Effects (continued)

- c. Reservoirs could not be constructed in waters of the U.S. to collect produced water from oil or gas wells (other than CBM wells) due to water quality limitations imposed by the WDEQ.
- d. CBM wells do not require construction of well pads.
- e. Access roads to CBM wells would cross streams at 1 location per well on average.
- f. Gathering pipelines for CBM wells cross streams at 2 locations per well on average.
- g. Ninety percent of streams in CBM production areas are ephemeral with no wetlands. The average road or pipeline crossing of perennial streams effects 0.03 acre of wetland.
- h. CBM wells discharge 0.01 cubic feet per second (cfs) on average (5 gallons per minute).
- i. Reservoirs would be constructed to collect produced water from CBM wells when the flow in a stream increases 1 cfs and half of the reservoirs include rehabilitation of an existing stock reservoir (i.e. one new reservoir per 200 CBM wells). Reservoirs would require filling 0.03 acre of wetland and would inundate 0.15 acre of wetland and 300 linear feet of stream on average.
- j. One grade control structure would be required in streams when the stream flow increases 5 cfs (i.e. one grade control per 500 CBM wells).

Based on the well data obtained from the WOGCC and the assumptions about oil and gas development described above, predictions of cumulative effects that could occur from projects authorized under GP 98-08 in the next five years were completed. The number of wells that may actually be drilled was also considered. Data from the WOGCC shows that approximately 80 percent of approved wells are actually drilled. Unfortunately, production information is confidential so the actual number of producing wells is unknown. The predictions were:

- a. Total area of wetlands effected by road and pipeline construction related to 532 private oil wells would be 80 acres and 3 acres would be effected by 11 well pads.
- b. Total area of wetlands effected by road and pipeline construction related to 620 federal oil wells would be 31 acres and no wetlands would be effected by well pads.
- c. Total area of wetlands effected by road and pipeline construction related to 162 private gas wells would be 24 acres and 1 acre would be effected by 3 well pads.
- d. Total area of wetlands effected by road and pipeline construction related to 1,880 federal gas wells would be 94 acres and no wetlands would be effected by well pads.
- e. Total area of wetlands effected by road and pipeline construction for 24,160 private CBM wells would be 217 acres.
- f. Total area of wetlands effected by road and pipeline construction for 10,400 federal CBM wells would be 93 acres.
- g. Total area of wetlands effected by 173 reservoirs would be 31 acres, including 5 acres of wetland filled, 26 acres of wetland inundated, and 10 miles of stream inundated.
- h. Total number of grade control structures would be 69.

4.4 Cumulative Effects (continued)

The analysis indicates that 114 acres of wetland could be effected by activities related to oil wells, 119 acres of wetland could be effected by activities related to gas wells, and 341 acres of wetland could be effected by activities related to CBM wells for a cumulative total of 574 acres. However, approximately one third of the effects would be due to pipeline construction and are considered temporary. Therefore, it has been estimated that 365 acres of wetland could be filled over a 5 year period.

In summary, an estimated 3,500 acres of wetland has been effected by past oil and gas exploration and development activities which is approximately 0.2 percent of the total wetland area in Wyoming. Issuance of GP 98-08 could result in temporary disturbance of 37 acres and filling of 73 acres of wetland per year on average if 1,152 oil wells, 2,042 gas wells, and 34,560 CBM wells are completed in the next 5 years and if GP 98-08 is used for all authorizations. However, wetland mitigation will be required to compensate for all temporary effects and approximately 90 percent of the filled areas. Therefore, a net loss of 7 acres per year is anticipated. In order to confirm these predictions, the Corps will begin to monitor actual wetland effects associated with oil and gas exploration and development by using GP 98-08 exclusively and by conditioning the use of GP 98-08 to require accurate reporting for all authorized activities.

4.5 Prohibitions (230.10(b)):

- 4.5.1 State Water Quality Standards - See paragraph 3.2.3
- 4.5.2 Toxic Effluent Standards - See paragraph 3.2.3
- 4.5.3 Threatened and Endangered Species - See paragraph 3.2.2
- 4.5.4 Marine Sanctuaries - Not Applicable

4.6 Significant Degradation (230.10(c)):

Except as provided under 404(b)(2), no discharge of dredged or fill material shall be permitted which will cause significant degradation of the waters of the United States. Findings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations, and tests required by Subparts B and G after consideration of Subparts C-F with special emphasis on the persistence and permanence of the effects outlined in those subparts.

4.6.1 Physical/Chemical Characteristics (Subpart C):

4.6.1.1 Physical Substrate (230.20) - The substrate would be altered by all of the activities by filling the surface of wetlands and below the surface in streams, primarily ephemeral streams. The substrate in most cases would be lost and converted to dry land. None of the activities would alter the substrate in lakes, reservoirs, or other open water bodies.

4.6.1.2 Suspended Particulates/Turbidity (230.21) - All activities must comply with the applicable water quality standards, including turbidity.

4.6.1.3 Water (230.22) - The discharge of fill into streams and wetlands does not usually result in the addition of other pollutants that could effect water quality, other than turbidity. However, oil and gas production can generate numerous hazardous chemicals that could effect water quality. Any discharges due to storm water runoff or point discharges of produced water that may effect aquatic resources are controlled by the WDEQ under Section 402.

4.6.1.4 Current Patterns and Water Circulation (230.23) - Activities associated with oil and gas production such as roads, well pads, and pipelines would normally have very little effect on water flow and circulation. However, natural gas production from CBM wells can result in significant changes in both quantity and timing of flows due to the discharge of produced water directly into streams. However, the Corps has no authority to control the discharge of produced water. See paragraph 3.2.12.

4.6.1.5 Normal Water Fluctuations (230.24) - See paragraph 4.6.1.4.

4.6.1.6 Salinity Gradients (230.25) - Increases in salinity are not anticipated as a direct result of discharging fill material but discharges of produced water from CBM wells may effect salinity in surface waters. However, all authorized activities must comply with appropriate water quality standards imposed by the WDEQ, including salinity.

4.6.2 Biological Characteristics (Subpart D):

4.6.2.1 Threatened and Endangered Species (230.30) - See paragraph 3.2.2

4.6.2.2 Fish and Other Aquatic Organisms (230.31) - See paragraph 3.2.2

4.6.2.3 Other Wildlife (230.32) - See paragraph 3.2.2

4.6.3 Special Aquatic Sites (Subpart E):

4.6.3.1 Sanctuaries and Refuges (230.40) - Oil and gas exploration and development is prohibited in sanctuaries and refuges.

4.6.3.2 Wetlands (230.41) - See paragraph 3.2.1

4.6.3.3 Mud Flats (230.42) - No oil or gas facilities would be in mud flats.

4.6.3.4 Vegetated Shallows (230.43) - Oil and gas wells would not be located in vegetated shallows.

4.6.3.5 Coral Reefs (230.44) - Not Applicable

4.6.3.6 Riffle and Pool Complexes (230.45) - Activities that may effect riffle and pool complexes are reservoirs and grade control structures. Neither is expected to cause adverse effects because only small reservoirs are authorized and grade control helps to preserve the natural slope.

4.6.4 Human Use Characteristics (Subpart F):

4.6.4.1 Municipal and Private Water Supplies (230.50) - See paragraph 3.2.12.

4.6.4.2 Recreational and Commercial Fisheries (230.51 & E.O. 12962) - No adverse effects on fisheries are anticipated.

4.6.4.3 Water Related Recreation (230.52) - No adverse effects are anticipated.

4.6.4.4 Aesthetics (230.53) - No adverse effects on the aesthetics of aquatic ecosystems are anticipated. Aesthetics may be improved in some aquatic areas due to more lush vegetation from discharges of produced water from CBM wells.

4.6.4.5 National Parks, Monuments, Seashores, Wilderness Areas, Research Sites and Preserves (230.54) - Oil and gas exploration and development is prohibited in these areas.

4.6.5 Contaminant Evaluation and Testing (Subpart G):

4.6.5.1 Dredged or Fill Material (230.60) - After consideration of potential adverse effects of discharges under Subparts C-F, it was determined that the probability that fill material will contain contaminants is extremely low due to the nature of the activities and requirements imposed by other regulatory agencies. Any potential discharge of contaminated soils would be regulated under Section 402 of the CWA. Therefore, testing is not warranted.

4.6.5.2 Chemical, Biological, and Physical (230.61) - The likelihood of contamination is acceptably low and mandatory testing is not required but the Corps has the ability to require additional information to determine if testing is warranted for specific projects prior to receiving authorization.

4.7 Minimization of Impacts (Subpart H):

4.7.1 Actions concerning the Location of the Project (230.70) - See paragraph 3.1.3

4.7.2 Actions controlling Dredged or Fill Material (230.71, 72, and 73) - The appropriate action is to include permit conditions to protect water quality such as soil erosion and sediment control.

4.7.3 Actions related to Technology (230.74) - See paragraph 3.1.2

4.7.4 Actions affecting Plant and Animal Populations (230.75) - The appropriate action is permit conditions to protect T&E species, spawning areas, aquatic life movement, and limited land clearing.

4.7.5 Actions affecting Human Use (230.76) - No action is necessary.

4.7.6 Other Actions (230.77) - An additional permit condition to restrict activities within 100 feet of the water source in unique spring areas is important to protect those resources. No other actions beyond permit conditions are necessary.

4.8 Compliance Determination (40 CFR Part 230.10):

The Corps has reviewed and evaluated this permit action in the context of the 404(b)(1) Guidelines regulations published at 40 CFR Part 230. The following paragraphs summarize the results of the evaluation and how the project complies with the above cited regulations.

4.8.1 Are there practicable project alternatives that have less adverse impact on the aquatic ecosystem and are without other significant adverse environmental consequences (230.10(a)) ? See part 3.1.

4.8.2 If the project is in a special aquatic site and is not water dependent, are there other practicable project alternative locations available (230.10 (a))? Not Applicable

4.8.3 Will the project violate any State water quality standards (230.10(b)) ? No, provided activities are accomplished in accordance with conditions of the WDEQ's certification.

4.8.4 Will the project violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act (230.10(b)) ? No

4.8.5 Will the project jeopardize the continued existence of species, or their critical habitat, listed as endangered or threatened under the Endangered Species Act of 1973, as amended (230.10(b)) ? No, provided activities are accomplished in accordance with permit conditions relevant to T&E species.

4.8.6 Will the project cause or contribute to significant degradation of waters of the United States (230.10(c)): Considering the discussion in section 4.5, will the project cause significant adverse effects on;

human health or welfare ? No

aquatic life and other wildlife dependent on aquatic ecosystems ? No

aquatic ecosystem diversity, productivity, and stability ? No

recreation, aesthetics, or economic values ? No

4.8.7 Have all practicable steps been taken to minimize the adverse effects of the project on the aquatic ecosystem (230.10(d)) ? Yes

4.8.8 Have the project's Cumulative and Secondary Effects been considered (230.11(g,h)) ? Yes, potential cumulative effects have been considered during development of GP 98-08 and potential secondary effects will be evaluated prior to issuance of final authorization for specific projects.

Chapter 5

Statement of Findings (33 CFR Part 325.2(a)(6))

5.1 Public Interest (33 CFR Part 320.4):

On behalf of the District Engineer, I have determined that issuance of Department of the Army General Permit 98-08 with special conditions is not contrary to the Public Interest.

5.2 404(b)(1) Guidelines (40 CFR Part 230.12):

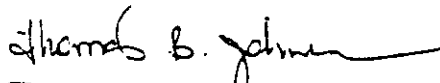
On behalf of the District Engineer, I have determined that issuance of Department of the Army General Permit 98-08 complies with the guidelines, with inclusion of appropriate and practicable conditions discussed in parts 3.2, 4.3, and 4.7 to minimize pollution or adverse effects to the aquatic ecosystem.

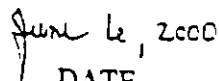
5.3 Clean Air Act (Section 176(c)) - Department of the Army General Permit 98-08 has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. It has been determined that the activities proposed under this permit will not exceed de minimis levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons a conformity determination is not required for this permit.

5.4 National Environmental Policy Act (33 CFR Part 325.2(a)(4)):

On behalf of the District Engineer, I have evaluated the information provided by the applicant and other interested parties. I have determined that issuance of Department of the Army General Permit 98-08 will not have a significant impact on the quality of the human environment and that an Environmental Impact Statement is not required. This is a Finding of No Significant Impact (FONSI).

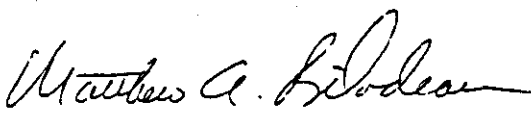
Prepared by


Thomas B. Johnson, P.E.
Project Manager
Wyoming Regulatory Office

 June 16, 2000
DATE


Chapter 5 (continued)

Reviewed by


Matthew A. Bilodeau
Program Manager
Wyoming Regulatory Office


6/6/00
DATE

Reviewed by

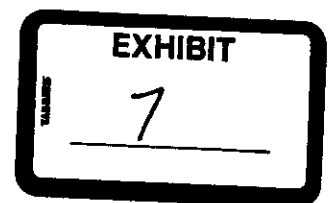

Kathryn M. Schenk, P.E.
Chief, Regulatory Branch
Operations Division

DATE 2/2 June 2000

Approved by


Paul R. Wernhoener, P.E.
Chief, Operations Division

DATE 6/20/00



Talking Points

- 1) Most are familiar with Section 404 of the CWA, enacted October 1972 ^{FURCA}
requires that all persons obtain authorization from the USACE prior to
discharging fill material into streams, lakes, wetlands, known as
"waters of the U.S." includes ephemeral streams but not
irrigated lands that would be dry otherwise
- 2) The Corps has developed GPs to streamline the permit review process
for activities with minor impacts that are very common such as,
road crossings + pipelines, two types National and Regional, ^{Regulatory}
However, is the past NWP 24 authorized many activities and up to
1 acre prior to January 1997, without a permit to the Corps.
Now it's 1/3 acre and will expire completely on 15 September 1999.
- 3) Therefore, need to develop a new GP to cover oil + gas activities
to replace NWP 24 and takes advantage of analysis done by other
agencies. "Due Stop Stopping", allows the lead agency to assist producer
All agencies must comply with NEPA, ESA and NHPA.
^{Regulatory} a. GP 98-03 recognizes that and allows project to proceed when another
^{GP} agency has the lead (oversight) without notification of the Corps, (EPA)
does require statement of compliance for > 1/3 ac or 300 ft
b. Can also be used when there is no other federal involvement but requires
notification of Corps in advance
- 4) Walk through the permit language
activities - define single project
conditions - mitigation
- 5) Fee waiver comments through April 1st, related to those operators who are
in the BLM's system already

1) Transfer to BLM, WO+DCC, PAW proposal is a process to streamline the permit process

2) Sub-goal

1972 FURCA, 5404, new rule, WUS definition control disposal of debris & fill
 1977 CWA, expanded to include all uses that contribute to increased resource
 early 1980s, full implementation necessary
 mid 80s - need to simplify process for routine activity, revised impact
 of rule, pipelines

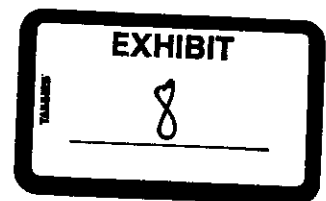
CRS is that process - two types NWP & regional
 NWPS 12, 14 the authorized most used the up till now
 NWP 26 used extensively, 10 + 1 accepted up to Jan 97
 NWP 26 - significant down impacts, caps agreed to reduce by Sept 15, 99
 we recognized a need to develop a CR to replace NWP 26, also recognize
 all activity + fix off using regulatory programs - ex Parametric
 Bys with BLM last sent to develop CR 99-08
 As currently proposed, roads, pipelines, reservoirs
 special criteria + key mineral
 Single Project, - single part
 Various levels, pipelines are unique
 Not restricted

Private - most not in scope in advance similar to NWPS

Public - allows third party access to determine if a project
 needs for criteria and provide permit directly to the proponent
 no advance, clear must have to ensure purpose
 Standard of compliance - over 0.33 acre under review

Public notice visit ready, Meeting list provided by BLM
 not one gets a call

not a list, I have copies
 encourage comments by 1 April





US Army Corps
of Engineers
Omaha District

PUBLIC NOTICE

Application No: 199820008

Applicant: General Public

Waterway: Waters of the U.S. in Wyoming

Issue Date: March 3, 1999

Expiration Date: April 1, 1999

11/2
1.1
CP

30 DAY NOTICE

Regulatory Branch

2232 Dell Range Blvd.

Cheyenne, Wyoming 82009-4942

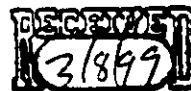
JOINT PUBLIC NOTICE

U.S. ARMY CORPS OF ENGINEERS
AND
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
AND
U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL PERMIT 98-08

The District Engineer, Omaha District, U.S. Army Corps of Engineers, P.O. Box 5, Omaha, Nebraska, 68101-0005 proposes to issue General Permit 98-08 (GP 98-08), pursuant to Section 404 of the Clean Water Act of 1972. The purpose of GP 98-08 would be to authorize oil and gas exploration, development, transportation, and distribution activities that impact wetlands and other waterbodies on private and public lands in Wyoming.

Under the authority of Section 404, the Corps regulates the discharge of dredged and fill material in waters of the United States, including wetlands. GP 98-08 would be issued in accordance with the "Regulatory Programs of the Corps; Final Rule," as published in the Federal Register, Volume 51, Number 219, dated November 13, 1986. Sections 322.2(f) and 323.2(h) of those regulations define general permits as Department of the Army authorization that is issued on a nationwide or regional basis for a category or categories of activities when (1) those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts; or (2) the general permit would result in avoiding unnecessary duplication of regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal. General Permits that are founded on an existing regulatory program and designed to avoid duplication with that program are defined in Part 325.5(c)(3) as Programmatic Permits. Part 325.2(e)(2) gives the District Engineer authority to issue general permits on a regional basis after compliance with the other procedures of this regulation.



A general permit for oil and gas exploration, development, transportation, and distribution activities is necessary because many activities with minor environmental impacts are currently authorized by Nationwide Permit 26 which is scheduled to expire on September 15, 1999. If issued, General Permit (GP) 98-08 would facilitate authorization of specific activities with minor environmental impacts; such as, roads, well pads, reservoirs, and pipelines. Activities that could be authorized by GP 98-08 are described in Appendix A.

All authorized activities must be accomplished in compliance with specific conditions as described in Appendix B. Appendix B contains conditions that the Corps believes are necessary for compliance with regulations and policies established pursuant to the goal of the Clean Water Act of 1972, which is "...to restore and maintain the chemical, physical, and biological integrity of the nation's waters." Protection of wetlands is important because wetlands provide a number of functions that are important to maintaining clean water; including, flood flow attenuation, sediment trapping, nutrient removal, groundwater recharge, and erosion protection.

Prospective permittees would be required to notify the Corps in accordance with procedures described in Appendix C and receive written authorization from the Corps prior to undertaking activities on non-federal lands with non-federal minerals. GP 98-08 would serve as a Programmatic Permit for activities on federal lands and non-federal lands with federal minerals because other agencies such as the U.S. Bureau of Land Management and U.S. Forest Service, as the lead federal agency, evaluate the environmental consequences of actions and must comply with requirements of the National Environmental Policy Act of 1969, Endangered Species Act of 1972, National Historic Preservation Act of 1966, Executive Order 11990 for the Protection of Wetlands, and other federal laws. The procedure for obtaining authorization for activities in areas where the Corps is not the lead federal agency is also described in Appendix C.

At this time, the Corps is soliciting comments from the public; federal, state and local agencies and officials; Indian tribes; and other interested parties in order to properly evaluate the potential impacts of activities that would be authorized under GP 98-08. Any comments received will be considered by the Corps to determine whether to issue, modify, condition or deny GP 98-08. The decision whether to issue GP 98-08 will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activities on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the proposed activities must be balanced against any reasonably foreseeable detriments. All factors which may be relevant to the decision will be considered; including, water quality, wetlands, historic properties, fish and wildlife, flood plains, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production, mineral needs, conservation, economics, aesthetics, considerations of property ownership and, in general, the needs and welfare of the public. In addition, the Corps evaluation will include application of guidelines promulgated by the Administrator, U.S. Environmental Protection Agency, under the authority of Section 404(b) of the Clean Water Act of 1972 (40 CFR Part 230). The guidelines establish specific criteria for evaluating permits and the guidelines prohibit issuance of permits for discharges into special aquatic sites when there are less damaging practicable alternatives.

Comments are also used to determine the need for a public hearing and the overall public interest in activities that could be authorized. Any person may request, in writing and within the comment period specified in this notice, that a public hearing be held for the purpose of gathering additional information. Requests for public hearings must be identified as such and shall state specifically the reasons for holding a public hearing. Requests must be submitted to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Any interested party (particularly officials of any town, county, state, federal agency, or local association whose interests may be affected by activities to be authorized under GP 98-08) is invited to submit to this office written facts, arguments, or objections on or before the expiration date of this notice. Any agency or individual having an objection to the proposed GP 98-08 should specifically identify it as an objection with clear and specific reasons. Comments, both favorable and unfavorable, will be accepted, made a part of the record and will receive full consideration in subsequent actions on this permit.

The Wyoming Department of Environmental Quality (WDEQ) and the U.S. Environmental Protection Agency (EPA) have authority to place additional limitations and conditions on authorized activities under authority of Section 401 of the Clean Water Act of 1972. Section 401 gives the WDEQ authority to further regulate activities requiring a federal license or permit, such as a Section 404 permit, based on concerns for state water quality and the EPA has that same authority concerning water quality on the Wind River Indian Reservation. Section 404 permits, including general permits, cannot be issued without certification from the WDEQ or EPA that authorized activities will not violate applicable water quality standards. The WDEQ has adopted standards for protection of wetlands in Wyoming from projects that would "...cause the destruction, damage or impairment of naturally occurring wetlands except when mitigated through an authorized mitigation process." The WDEQ and EPA will also consider comments with an intent to certify in accordance with provisions of Section 401 of the Clean Water Act. Certification, if issued, will express the WDEQ's and EPA's opinion that authorized activities will not result in a violation of applicable water quality standards. The WDEQ and EPA hereby incorporate this public notice as their own public notice and procedures by reference thereto.

If issued, GP 98-08 would be in effect for a period of five years from date of issuance. However, it would be subject to extension, modification, suspension, or revocation by the District Engineer in accordance with applicable regulations and in consideration of the public interest as noted above. The District Engineer retains discretionary authority to prohibit the use of GP 98-08 on a case-by-case basis and require the submittal of an individual permit if it is determined that a particular activity would result in more than minimal impacts to the aquatic environment.

In compliance with the National Historic Preservation Act (NHPA) of 1966 and 36 CFR 800, the lead federal agency will check the National Register of Historic Places and its current supplements and coordinate with the Wyoming State Historic Preservation Office (WSHPO) as required. Regardless of the procedure, activities cannot be authorized without a determination that the activities would have "no effect" on historic properties. The Corps will also consider comments concerning the procedure for protection of historic properties and cultural resources provided by the WSHPO and others in response to this public notice.

In compliance with the Endangered Species Act (ESA) of 1972, the lead federal agency will evaluate each activity for potential adverse affects on threatened or endangered species and critical habitat. If it is determined that an activity may affect a species designated as threatened or endangered, or its critical habitat, the lead federal agency will consult with the U.S. Fish and Wildlife Service (USFWS) to resolve the issue. Regardless of the procedure, activities cannot be authorized that are likely to jeopardize the continued existence of a federally listed threatened or endangered species or critical habitat. The Corps will also consider comments concerning the protection of threatened or endangered species provided by the USFWS and others in response to this public notice.

All replies to this public notice should be sent to the Corps at the address listed above. Mr. Thomas Johnson, in the Wyoming Regulatory Office may be contacted for additional information at (307) 772-2300.

Comments received after the close of business on the expiration date of this public notice will not be considered.

APPENDIX A

AUTHORIZED ACTIVITIES

As currently proposed, GP 98-08 would authorize the following types of activities. Each activity may be implemented individually or in combination with another activity. All authorized activities must comply with conditions listed in Appendix B.

1. **Road Construction:** The purpose of this activity is to provide access to a well location. Roads can be temporary or permanent. Road crossings of waters of the U.S. must be culverted, bridged, or otherwise designed to allow passage of expected high flows. Crossings that are designed to function as fords are acceptable. A single road crossing cannot impact more than 0.25 acre of waters of the U.S., including wetlands, and the cumulative impacts for a single road cannot exceed 1.0 acre.
2. **Pad Construction:** The purpose of this activity is to create a suitable platform for well drilling and production facilities. A single pad cannot impact more than 0.33 acre of waters of the U.S. Construction of pads may also require modification of small stream channels to accommodate the pad. Stream channel alterations are authorized on ephemeral streams only and a single pad cannot impact more than 500 linear feet of a stream.
3. **Reservoir Construction:** The purpose of this activity is to construct impoundments for collection of excess water produced by wells. Construction of reservoirs for containing petroleum products other than produced water is not authorized. However, produced water may contain minor amounts of petroleum products and all reservoir projects must comply with Wyoming Water Quality Rules and Regulations, Chapter 1, Section 29 concerning oil and grease accumulation. Reservoirs cannot be constructed on perennial streams and cannot inundate more than 1,000 linear feet of stream and 0.50 acre of wetland when constructed on ephemeral streams.
4. **Pipeline Construction:** The purpose of this activity is to transport products from a well to storage and processing facilities. Pipelines include local gathering systems and main transmission lines. There is no limit on the area of waters of the U.S. that can be temporarily disturbed during pipeline construction but the width of all disturbance in wetland areas is limited to 50 feet and all disturbed area must be restored to pre-project conditions. Restoration includes reestablishing natural ground contours and replacement of wetland soils in the upper 12 inches of the trench in wetland areas. Pipeline projects must also be designed to prevent the trench and bedding material from acting as a sub-surface drain in wetlands. It may be necessary to install ditch plugs or collars to prevent drainage. Directional drilling at stream crossings is encouraged and may be required to avoid other adverse environmental consequences.
5. **Mitigation.** The purpose of this activity is to replace wetlands and other waters impacted by construction activities. Most forms of mitigation do not require specific authorization, such as wetland creation in upland areas. However, there are situations where construction of a mitigation area has minor impacts on existing waters of the U.S., such as expansion of an existing wetland or pond. Wetland impacts due to mitigation activities are limited to 0.33 acre for each mitigation site.

APPENDIX B

PERMIT CONDITIONS

1. **Single and Complete Project:** The cumulative impacts from a single project cannot exceed two (2) acres of waters of the U.S., including wetlands. All areas filled, inundated, excavated, or drained are considered to be impacted. For purposes of this permit, a single project is defined as all activities undertaken in accordance with development of a single pad, including roads and production facilities, except for pipeline construction activities. However, the Corps reserves the right to define a single and complete project for purposes of GP 98-08 on a case-by-case basis.
2. **Water Quality:** The permittee must comply with any conditions established by the Wyoming Department of Environmental Quality, Water Quality Division in accordance with its authority under Section 401 of the Clean Water Act of 1972.
3. **Erosion and Siltation Controls:** Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any disturbed areas below the ordinary high water mark must be permanently stabilized at the earliest practicable date.
4. **Historic Properties:** No activity is authorized that would adversely affect sites included in the most current listing of the National Register of Historic Places or sites known to be eligible for such listing, sites included in the National Register of Natural Landmarks, or any other known historic, cultural, or archaeological sites until the District Engineer has complied with the provisions of 33 CFR Part 325, Appendix C pursuant to the National Historic Preservation Act of 1966.
5. **Threatened and Endangered Species:** No activity is authorized that is likely to jeopardize the continued existence of species, or critical habitats, designated or proposed for designation as threatened or endangered pursuant to the Endangered Species Act of 1972.
6. **Wild and Scenic Rivers:** No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless, the appropriate federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service).
7. **Tribal Rights:** No activity is authorized that would impair reserved Tribal rights; including, but not limited to, mineral, water, fishing, and hunting rights.
8. **Suitable Fill Material:** No discharge may consist of unsuitable materials (e.g., trash, debris car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts as required by Section 307 of the Clean Water Act. In Wyoming, the Corps issued a prohibition against the use of certain materials as fill in a Public Notice issued on March 21, 1994, and copies are available.
9. **Proper Maintenance:** Any structure authorized, particularly impoundments, must be properly maintained, including maintenance necessary to ensure public safety.

APPENDIX B (continued)

PERMIT CONDITIONS

10. Aquatic Life Movement: No activity may substantially disrupt the movement of species indigenous to the waterbody, including migratory species, unless the activities purpose is to impound water.
11. Spawning Areas: No discharges are allowed in active spawning areas during the spawning season of fish and other aquatic life indigenous to the waterbody. General spawning seasons for the most common fish species in Wyoming are listed below:
- | | |
|-----------------------------|------------------------------------|
| Rainbow and Cutthroat Trout | - March 15 through July 31 |
| Brown and Brook Trout | - September 15 through November 30 |
- Permittees are encouraged to obtain site specific information on active spawning areas from Fisheries Supervisors in the Wyoming Game and Fish Department's Regional Offices.
12. Scrub-Shrub Wetlands: No project is authorized that would impact more than 0.10 acre of scrub-shrub wetland as identified under the Cowardin classification system. Any area identified on a National Wetland Inventory (NWI) map with a "PSS" classification is likely to be a scrub-shrub wetland.
13. Forested Wetlands: No project is authorized that would impact more than 0.05 acre of forested wetlands as identified under the Cowardin classification system. Any area identified on a NWI map with a "PFO" classification is likely to be a forested wetland.
14. Organic Soils: No project is authorized that would impact more than 0.05 acre in wetland areas with organic soils which are defined as those areas with at least 8 inches of peat at the surface (Histosols) and in some cases more than 16 inches of peat (Histosols).
15. Springs: No activity is authorized within 100 feet of the source in natural spring areas. For purposes of this condition, a spring source is defined as any location where there is natural artesian flow emanating from a distinct point at any time during the growing season. Springs do not include seeps and other groundwater discharge areas where there is no distinct point source.
16. Mitigation: Projects that permanently impact more than 0.33 acre of wetland for all activities combined must be designed to restore or create similar wetland (in-kind) elsewhere, preferably near the project area (on-site), at a replacement ratio of at least 1:1. Construction of the mitigation area must be concurrent with construction of the project and must be completed when the project is completed. Mitigation must be successful to satisfy this requirement. Success of the mitigation area will be based upon plant species and composition. There must be at least 60 percent coverage of the entire mitigation area with a dominance of hydrophytic plant species in all vegetation layers within 3 years after construction. If mitigation is unsuccessful, the permittee will be required to mitigate the project's wetland impacts by implementing another method to be approved by the lead federal agency and the Corps.
17. Stockpiling: Storage of excess soil or unwanted vegetation in waters of the U.S. areas will be authorized on a temporary basis only, not to exceed three (3) months. Stockpiling of materials is not allowed in flowing or standing water.

APPENDIX C

NOTIFICATION PROCEDURES

For activities located on non-federal lands with non-federal minerals, the producer (applicant) or a designated agent for the applicant must notify the U.S. Army Corps of Engineers with a Pre-Construction Notification (PCN) as early as possible and prior to initiating any activities under General Permit (GP) 98-08 that are subject to regulation under Section 404 of the Clean Water Act. All PCN's must be in writing and must include project specific information as described in Items 1-6 below. The standard permit application form (Form ENG 4345) may be used for the notification, but must clearly indicate that it is a PCN for GP 98-08.

1. Full name, mailing address, contact person, and telephone number(s) of the applicant.
2. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
3. Brief project description including reference to all activities to be authorized.
4. Project drawings with appropriate dimensions of lengths and areas for all activities to be authorized.
5. Wetland delineation for projects that include road crossings, pads, or reservoirs if the project would impact more than 0.33 acre of wetland. Delineations must be prepared in accordance with Corps Wetland Delineation Manual dated January 1987. A PCN is not considered to be complete when a wetland delineation is required until the Corps receives a delineation. The applicant may hire a qualified consultant to complete a delineation and a list of consultants is available.
6. Mitigation plan for projects that impact more than 0.33 acre of wetland. The plan must include a complete description of soil and water manipulation techniques, revegetation techniques, plan view and cross-sectional drawings, and a map that shows the mitigation area location.
7. Photographs of the project area and proposed mitigation area.

All Pre-Construction Notification's must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Questions concerning PCN procedure should be directed to the Wyoming Regulatory Office at the above address or by telephone at (307) 772-2300.

APPENDIX C (continued)

STATEMENT OF COMPLIANCE

For activities located on federal lands or non-federal lands with federal minerals, advance notification of the Corps is not required for authorization under General Permit (GP) 98-08. However, the permittee must submit the following Statement of Compliance for projects that impact more than 0.33 acre or 300 linear feet of waters of the U.S. The purpose of this form is to document completion of activities authorized under GP 98-08. The permittee must submit this form along with the information requested in Items 1-10 below within 30 days after completion of authorized activities. Please note that information for Item 7 must be obtained from the lead federal agency.

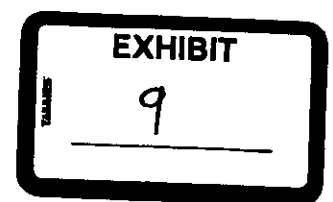
1. Full name, mailing address, contact person, and telephone number of the permittee.
2. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
3. Brief project description including reference to the well name and all authorized activities.
4. Project drawings with appropriate dimensions of lengths and areas for all authorized activities.
5. Date construction began.
6. Date construction was completed.
7. The following information must be obtained from the lead federal agency's NEPA document for road crossings, pads, and reservoirs that impact wetlands:
 - a. Full name, mailing address, contact person, and telephone number of the lead federal agency.
 - b. Area of wetland filled for each activity.
 - c. Length of stream channel filled and area of the channel inundated for reservoirs.
 - d. Area of wetland inundated by reservoirs.
8. Description of mitigation strategy for projects that impact 0.33 acre or more wetland, including a map showing the mitigation area location.
9. Date mitigation was completed.
10. Photographs of the project area and mitigation area.

I hereby certify that the activities described above were completed in accordance with the terms and conditions of GP 98-08 and that all mitigation required as a condition of the permit was completed in accordance with appropriate mitigation guidelines. I understand that authorized activities are subject to inspection by a U.S. Army Corps of Engineers representative and that failure to comply with the terms and conditions of the permit could result in permit suspension, modification, or revocation.

Signature of Permittee

All Statements of Compliance must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942





**US Army Corps
of Engineers**
Omaha District

PUBLIC NOTICE

Application No: 199820008

Applicant: General Public

Waterway: Waters of the U.S. in Wyoming

Issue Date: April 15, 1999

Expiration Date: May 14, 1999

30 DAY NOTICE

Regulatory Branch

2232 Dell Range Blvd.

Cheyenne, Wyoming 82009-4942

JOINT PUBLIC NOTICE

**U.S. ARMY CORPS OF ENGINEERS
AND
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
AND
U.S. ENVIRONMENTAL PROTECTION AGENCY**

PROPOSED GENERAL PERMIT 98-08

On March 3, 1998, the U.S. Army Corps of Engineers, Wyoming Regulatory Office issued a 30-day Public Notice announcing a proposal by the District Engineer, Omaha District, U.S. Army Corps of Engineers, P.O. Box 5, Omaha, Nebraska, 68101-0005 to issue General Permit 98-08 (GP 98-08), pursuant to Section 404 of the Clean Water Act of 1972. The purpose of GP 98-08 would be to authorize oil and gas exploration, development, transportation, and distribution activities that impact wetlands and other waterbodies on private and public lands in Wyoming. In response to that notice, several organizations requested an extension of the comment period in order to allow sufficient time for other interested parties to comment.

As requested, this notice extends the comment period on the proposed GP 98-08 for another 30 days. In addition, this notice provides more detailed information on the proposal and contains revised permit criteria based upon comments provided in response to the previous notice. For instance, the proposed permit now includes cleanup activities. Therefore, this notice supersedes the previous notice issued on March 3, 1999.

Under the authority of Section 404, the Corps regulates the discharge of dredged and fill material in waters of the United States, including wetlands. GP 98-08 would be issued in accordance with the "Regulatory Programs of the Corps; Final Rule," as published in the Federal Register, Volume 51, Number 219, dated November 13, 1986. Sections 322.2(f) and 323.2(h) of those regulations define general permits as Department of the Army authorizations



that are issued on a nationwide or regional basis for a category or categories of activities when (1) those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts; or (2) the general permit would result in avoiding unnecessary duplication of regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal. General Permits that are founded on an existing regulatory program and designed to avoid duplication with that program are defined in Part 325.5(c)(3) as Programmatic Permits. Part 325.2(e)(2) gives the District Engineer authority to issue regional general permits after compliance with other procedures of the regulation.

A general permit for oil and gas exploration, development, transportation, and cleanup activities in Wyoming is necessary because many of those activities are currently authorized by Nationwide Permits (NWP) 6, 12, 14, 20, 26, and 33. Those permits will continue to be available, except for NWP 26 is now scheduled to expire on September 15, 1999. The draft GP 98-08 described herein consolidates all of the various forms of authorization into one permit but does not eliminate or modify any other permits. Obviously, the existence of more than one potential form of authorization does not imply that more than one permit is required. For instance, construction of a pipeline could be authorized under NWP 12 or under GP 98-08 but not both. However, there would be advantages to having one form of authorization for a single project that includes several related activities.

If issued, GP 98-08 would facilitate authorization of specific activities with minor environmental impacts; such as construction of roads, well pads, reservoirs, and pipelines as well as oil spill cleanup. Activities that could be authorized by GP 98-08 are described in Appendix A. The proposed permit criteria in Appendix A are in draft form and are subject to change.

All authorized activities must be accomplished in compliance with specific conditions as described in Appendix B. Appendix B contains conditions that the Corps believes are necessary for compliance with regulations and policies established pursuant to the goal of the Clean Water Act of 1972, which is "...to restore and maintain the chemical, physical, and biological integrity of the nation's waters." Protection of wetlands is important because wetlands provide a number of functions that are important to maintaining clean water; including, flood flow attenuation, sediment trapping, nutrient removal, groundwater recharge, and erosion protection.

Prospective permittees would be required to notify the Corps in accordance with procedures described in Appendix C and receive written authorization from the Corps prior to undertaking activities that impact more than 0.33 acre of wetland on non-federal lands with non-federal minerals. GP 98-08 would serve as a Programmatic Permit for activities on federal lands and non-federal lands with federal minerals because other federal agencies such as the U.S. Bureau of Land Management, evaluate the environmental consequences of actions and must comply with requirements of the National Environmental Policy Act of 1969, Endangered Species Act of 1972, National Historic Preservation Act of 1966, Executive Order 11990 for the Protection of Wetlands, and other federal laws. The procedure for obtaining authorization for activities in areas where the Corps is not the lead federal agency is also described in Appendix C.

The fact that authorization may be granted under GP 98-08 does not imply that restrictions imposed by another federal agency with jurisdiction over the project are no longer valid. In some instances, other federal agencies have requirements regarding wetlands and surface waters that are more restrictive than the Corps requirements. In all cases, the permittee would be required to comply with all applicable federal, state, tribal, and local rules and regulations.

At this time, the Corps is soliciting comments from the public; federal, state and local agencies and officials; Indian tribes; and other interested parties in order to properly evaluate the potential impacts of activities that could be authorized under GP 98-08. Any comments received will be considered by the Corps to determine whether to issue, modify, condition or deny GP 98-08.

The decision whether to issue GP 98-08 will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activities on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the proposed activities must be balanced against any reasonably foreseeable detriments. All factors which may be relevant to the decision will be considered; including, water quality, wetlands, historic properties, fish and wildlife, flood plains, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production, mineral needs, conservation, economics, aesthetics, considerations of property ownership and, in general, the needs and welfare of the public. In addition, the Corps evaluation will include application of guidelines promulgated by the Administrator, U.S. Environmental Protection Agency, under the authority of Section 404(b) of the Clean Water Act of 1972 (40 CFR Part 230). The guidelines establish specific criteria for evaluating permits and the guidelines prohibit issuance of permits for discharges into special aquatic sites when there are less damaging practicable alternatives.

Comments are also used to determine the need for a formal public hearing and the overall public interest in activities that could be authorized. Any person may request, in writing and within the comment period specified in this notice, that a public hearing be held for the purpose of gathering additional information. Requests for public hearings must be identified as such and shall state specifically the reasons for holding a public hearing. Requests for a less formal public meeting for the purpose of disseminating information on the proposed GP 98-08 will also be considered. Others have already indicated interest in holding public meetings in Pinedale and Gillette and the Corps is currently considering those requests.

Any interested party (particularly officials of any town, county, state, federal agency, or local association whose interests may be affected by activities to be authorized under GP 98-08) is invited to submit to this office written facts, arguments, or objections on or before the expiration date of this notice. Any agency or individual having an objection to the proposed GP 98-08 should specifically identify it as an objection with clear and specific reasons. Comments, both favorable and unfavorable, will be accepted, made a part of the record and will receive full consideration in subsequent actions on this permit.

The Wyoming Department of Environmental Quality (WDEQ) and the U.S. Environmental Protection Agency (EPA) have authority to place additional limitations and conditions on authorized activities under authority of Section 401 of the Clean Water Act of 1972. Section 401 gives the WDEQ authority to further regulate activities requiring a federal license or permit, such as a Section 404 permit, based on concerns for state water quality and the EPA has that same authority concerning water quality on the Wind River Indian Reservation. Section 404 permits, including general permits, cannot be issued without certification from the WDEQ or EPA that authorized activities will not violate applicable water quality standards. The WDEQ and EPA will also consider comments with an intent to certify in accordance with provisions of Section 401 and hereby incorporate this public notice as their own public notice.

If issued, GP 98-08 would be in effect for a period of five years from date of issuance. However, it would be subject to extension, modification, suspension, or revocation by the District Engineer in accordance with applicable regulations and in consideration of the public interest as noted above. The District Engineer retains discretionary authority to prohibit the use of GP 98-08 on a case-by-case basis and require the submittal of an individual permit if a particular activity would result in more than minimal impacts to the aquatic environment.

In compliance with the National Historic Preservation Act (NHPA) of 1966 and 36 CFR 800, the lead federal agency will check the National Register of Historic Places and its current supplements and coordinate with the Wyoming State Historic Preservation Office (WSHPO) as required. Activities cannot be authorized without a determination that the activities would have "no adverse effect" on historic properties. The Corps will also consider comments concerning the procedure for protection of historic properties and cultural resources provided by the WSHPO and others in response to this public notice.

In compliance with the Endangered Species Act (ESA) of 1972, the lead federal agency will evaluate each activity for potential adverse affects on threatened or endangered species and critical habitat. If it is determined that an activity may affect a species designated as threatened or endangered, or its critical habitat, the lead federal agency will consult with the U.S. Fish and Wildlife Service (USFWS) to resolve the issue. Activities cannot be authorized that are likely to jeopardize the continued existence of a federally listed threatened or endangered species or critical habitat. The Corps will also consider comments concerning the protection of threatened or endangered species provided by the USFWS and others in response to this public notice.

All replies to this public notice must be sent to the Corps at the following address:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Mr. Thomas Johnson may be contacted for additional information at (307) 772-2300. Comments received after the expiration date of this public notice will not be considered.

APPENDIX A

AUTHORIZED ACTIVITIES

As currently proposed, GP 98-08 would authorize the following types of activities. Each activity may be implemented individually or in combination with another activity. All authorized activities must comply with conditions listed in Appendix B.

1. **Surveys:** The purpose of these activities is to gather relevant information about an area prior to development. Surveying activities include core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, soil survey and sampling, and historic resources surveys. Plugging of test wells for oil and gas explorations may also be necessary. The discharge of drilling mud and cuttings may require a separate permit under Section 402 of the Clean Water Act.
2. **Road Construction:** The purpose of this activity is to provide either temporary or permanent access to a well location. Road crossings of waters of the U.S. must be culverted, bridged, or otherwise designed to allow passage of expected high flows. Crossings that are designed to function as fords are acceptable. A single road crossing cannot impact more than 0.15 acre of waters of the U.S., including wetlands, and the cumulative wetland impacts for a single road cannot exceed 0.50 acre.
3. **Pad Construction:** The purpose of this activity is to create a suitable platform for well drilling and production facilities. A single pad cannot impact more than 0.33 acre of wetland. Construction of pads may also require modification of small stream channels to accommodate the pad. Stream channel alterations are authorized on ephemeral streams only and a single pad cannot impact more than 300 linear feet of a stream.
4. **Reservoir Construction:** The purpose of this activity is to construct impoundments for collection of excess water produced by wells. Construction of reservoirs for containing petroleum products other than produced water is not authorized. However, produced water may contain minor amounts of petroleum products and all reservoir projects must comply with Wyoming Water Quality Rules and Regulations, Chapter 1, Section 29 concerning oil and grease accumulation. A single reservoir cannot impact more than 0.33 acre of wetland.
5. **Pipeline Construction:** The purpose of this activity is to transport products from a well to storage and processing facilities. Pipelines include local gathering systems and main transmission lines. Construction of pipelines may also include temporary fills for construction access and dewatering activities such as cofferdams. The width of all surface disturbance in wetland areas is limited to 30 feet and all disturbed areas must be restored to pre-project conditions. Restoration includes reestablishing natural ground contours and replacement of wetland soil in the upper 12 inches of the trench in wetland areas. Pipeline projects must also be designed to prevent the trench and bedding material from acting as a sub-surface drain in wetlands. It may be necessary to install ditch plugs or collars to prevent drainage. Directional drilling at stream crossings is encouraged and may be required in some cases to avoid other adverse environmental consequences.

APPENDIX A

AUTHORIZED ACTIVITIES (continued)

6. Oil Spill Containment and Cleanup: The purpose of these activities is to contain spills of hazardous substances and to clean up the spill as quickly as possible. Containment and cleanup activities may include temporary berms, pits, or ditches to control spills as well as temporary access roads and pipelines.

7. Mitigation. The purpose of this activity is to replace wetlands and other waters impacted by construction activities. Most forms of mitigation do not require specific authorization, such as wetland creation in upland areas. However, there are situations where construction of a mitigation area has minor impacts on existing waters of the U.S., such as expansion of an existing wetland or pond. Wetland impacts due to mitigation activities are limited to 0.10 acre for each mitigation site.

APPENDIX B

PERMIT CONDITIONS

1. **Single and Complete Project:** The cumulative permanent impacts to waters of the U.S., including wetlands, for a single project cannot exceed one (1) acre. All areas filled, inundated or excavated at depths greater than 3 feet, or drained are considered to be impacted. For purposes of this permit, a single project is defined as all activities undertaken in accordance with development of a single pad, including roads and reservoirs, except for pipeline construction activities. However, the Corps reserves the right to define a single and complete project for purposes of GP 98-08 on a case-by-case basis.
2. **Water Quality:** The permittee must comply with any conditions established by the Wyoming Department of Environmental Quality, Water Quality Division in accordance with its authority under Section 401 of the Clean Water Act of 1972.
3. **Erosion and Siltation Controls:** Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any disturbed areas below the ordinary high water mark must be permanently stabilized at the earliest practicable date.
4. **Historic Properties:** No activity is authorized that would adversely affect sites included in the most current listing of the National Register of Historic Places or sites known to be eligible for such listing, sites included in the National Register of Natural Landmarks, or any other known historic, cultural, or archaeological sites until the District Engineer has complied with the provisions of 33 CFR Part 325, Appendix C pursuant to the National Historic Preservation Act of 1966.
5. **Threatened and Endangered Species:** No activity is authorized that is likely to jeopardize the continued existence of species, or critical habitats, designated or proposed for designation as threatened or endangered pursuant to the Endangered Species Act of 1972.
6. **Wild and Scenic Rivers:** No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless, the appropriate federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service).
7. **Tribal Rights:** No activity is authorized that would impair reserved Tribal rights; including, but not limited to, mineral, water, fishing, and hunting rights.
8. **Suitable Fill Material:** No discharge may consist of unsuitable materials (e.g., trash, debris, car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts as required by Section 307 of the Clean Water Act. In Wyoming, the Corps issued a prohibition against the use of certain materials as fill in a Public Notice issued on March 21, 1994, and copies are available.
9. **Proper Maintenance:** Any structure authorized, particularly impoundments, must be properly maintained, including maintenance necessary to ensure public safety.

APPENDIX B (continued)

PERMIT CONDITIONS

10. Aquatic Life Movement: No activity may substantially disrupt the movement of species indigenous to the waterbody, including migratory species, unless the activities purpose is to impound water.

11. Spawning Areas: No discharges are allowed in active spawning areas during the spawning season of fish and other aquatic life indigenous to the waterbody. General spawning seasons for the most common fish species in Wyoming are listed below:

Rainbow and Cutthroat Trout	- March 15 through July 31
Brown and Brook Trout	- September 15 through November 30

Permittees are encouraged to obtain site specific information on active spawning areas from Fisheries Supervisors in the Wyoming Game and Fish Department's Regional Offices.

12. Scrub-Shrub Wetlands: No project is authorized that would impact more than 0.05 acre of scrub-shrub wetland as identified under the Cowardin classification system. Any area identified on a National Wetland Inventory (NWI) map with a "PSS" classification is likely to be a scrub-shrub wetland.

13. Forested Wetlands: No project is authorized that would impact more than 0.05 acre of forested wetlands as identified under the Cowardin classification system. Any area identified on a NWI map with a "PFO" classification is likely to be a forested wetland.

14. Organic Soils: No project is authorized that would impact more than 0.05 acre in wetland areas with organic soils which are defined as those areas with at least 8 inches of peat at the surface (Histis epipedon) and in some cases more than 16 inches of peat (Histosols).

15. Springs: No activity is authorized within 100 feet of the source in natural spring areas. For purposes of this condition, a spring source is defined as any location where there is natural artesian flow emanating from a distinct point at any time during the growing season. Springs do not include seeps and other groundwater discharge areas where there is no distinct point source.

16. Mitigation: All projects must be designed to avoid wetlands and minimize impacts to wetlands that cannot be avoided. Applicants must restore wetlands to pre-project conditions in areas where permanent fill is not absolutely necessary, such as reducing the size of a well pad after the drilling operation is complete, as mitigation of those areas. Projects that permanently impact more than 0.33 acre of wetland for all activities combined must be designed to restore or create similar wetland (in-kind) elsewhere, preferably near the project area (on-site), at a minimum replacement ratio of 1:1 for all impacts. A replacement ratio of 2:1 will be required for off-site mitigation. Construction of the mitigation area must be concurrent with construction of the project and must be completed when the project is completed. Mitigation must be successful to satisfy this requirement. Success of the mitigation area will be based upon plant species and composition. There must be at least 60 percent coverage of the entire mitigation area with a dominance of hydrophytic plant species in all vegetation layers within 3 years after construction. Annual monitoring reports may be required to document mitigation results. If mitigation is unsuccessful, the permittee will be required to mitigate the project's wetland impacts by implementing another method to be approved by the Corps and the lead federal agency, if applicable.

17. Stockpiling: Storage of excess soil or unwanted vegetation in waters of the U.S., including wetlands, outside of an approved impact area is not authorized under any circumstances.

APPENDIX C

NOTIFICATION PROCEDURES

For activities located on non-federal lands with non-federal minerals, the producer (applicant) or a designated agent for the applicant must notify the U.S. Army Corps of Engineers with a Pre-Construction Notification (PCN) as early as possible and prior to initiating any activities under General Permit (GP) 98-08 that would impact more than 0.33 acre of wetland. All PCN's must be in writing and must include project specific information as described in Items 1-6 below. The standard permit application form (Form ENG 4345) may be used for the notification, but must clearly indicate that it is a PCN for GP 98-08.

1. Name, mailing address, contact person, and telephone number(s) of the applicant.
2. Names, mailing addresses, and telephone number(s) of adjacent property owners and a statement that they have been notified in advance and given an opportunity to comment on any projects that include a reservoir.
3. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
4. Brief project description including the well name and information on all activities to be authorized.
5. Project drawings with appropriate dimensions of lengths and areas for all activities to be authorized.
6. Wetland delineation for the entire project area. Delineations must be prepared in accordance with Corps Wetland Delineation Manual dated January 1987. A PCN is not considered to be complete until the Corps receives an acceptable wetland delineation. The applicant may hire a qualified consultant to complete a delineation and a list of consultants is available.
7. Mitigation plan for all projects that would permanently impact more than 0.33 acre of wetland. The plan must include a complete description of soil and water manipulation techniques, revegetation techniques, plan view and cross-sectional drawings, and a map that shows the mitigation area location.
8. Photographs of the project area and proposed mitigation area.

All Pre-Construction Notification's must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Questions concerning PCN procedure should be directed to the Wyoming Regulatory Office at the above address or by telephone at (307) 772-2300.

APPENDIX C (continued)

STATEMENT OF COMPLIANCE

For activities located on federal lands or non-federal lands with federal minerals, advance notification of the Corps is not required for authorization under General Permit (GP) 98-08. However, the permittee must submit the following Statement of Compliance for projects that impact more than 0.33 acre of wetland. The purpose of this form is to document completion of activities authorized under GP 98-08. The permittee must submit this form along with the information requested in Items 1-10 below within 30 days after completion of authorized activities. Please note that information for Item 7 must be obtained from the lead federal agency.

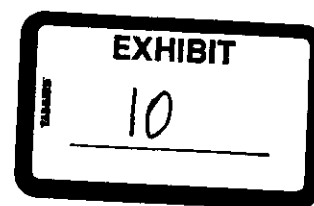
1. Full name, mailing address, contact person, and telephone number of the permittee.
2. Copy of the appropriate portion of a U.S. Geological Survey map with the project location labeled.
3. Brief project description including the well name and information on all authorized activities.
4. Project drawings with appropriate dimensions of lengths and areas for all authorized activities.
5. Date construction began.
6. Date construction was completed.
7. The following information must be obtained from the lead federal agency's NEPA document for road crossings, pads, and reservoirs:
 - a. Full name, mailing address, contact person, and telephone number of the lead federal agency.
 - b. Area of wetland filled for each activity.
 - c. Length of stream channel filled and area of the channel inundated for reservoirs.
 - d. Area of wetland inundated by reservoirs.
8. Description of mitigation strategy for projects that permanently impact more than 0.33 acre of wetland, including a map showing the mitigation area location.
9. Date mitigation was completed.
10. Photographs of the project area and mitigation area.

I hereby certify that the activities described above were completed in accordance with the terms and conditions of GP 98-08 and that all mitigation required as a condition of the permit was completed in accordance with appropriate mitigation guidelines. I understand that authorized activities are subject to inspection by a U.S. Army Corps of Engineers representative and that failure to comply with the terms and conditions of the permit could result in permit suspension, modification, or revocation.

Signature of Permittee

All Statements of Compliance must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 8
999 18TH STREET - SUITE 500
DENVER, CO 80202-2466

Ref: 8EPR-EP

MAY 10 1999

Matthew A. Bilodeau
State Supervisor
Cheyenne Regulatory Office
Corps of Engineers
2232 Dell Range Blvd., Suite 210
Cheyenne, WY 82009

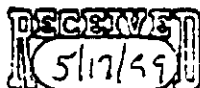
RE: Wyoming General Permit 98-08 Oil and Gas
Exploration, Development, Transportation,
and Distribution Activities Application #
199820008

Dear Mr. Bilodeau:

EPA has reviewed your April 15, 1999 Public Notice concerning modifications to a Clean Water Act § 404 General Permit (GP) for Oil and Gas Exploration, Development, Transportation, and Distribution Activities within Wyoming. We understand this notice responds to certain comments received on your March 3, 1999 public notice for the subject general permit, as well as extends the comment period. As we understand the changes, nearly every size limitation under the Authorized Activities has been reduced in an effort to assure that the impacts of the general permit are indeed minimal. We strongly support this proposal by the Corps.

However, one area where we believe the protections provided in the previous proposal have been greatly weakened is the Reservoir Construction Authorization. The previous version restricted reservoir construction to ephemeral streams and limited inundation to 1,000 linear feet of stream and 0.50 acre of wetland. While we support the current proposal's reduction of impacted wetland acreage to 0.33 acre, the current proposal does not include a limitation for the size of the reservoir, and now allows construction of the reservoir on any water of the U.S., not just ephemeral water bodies. It is conceivable that very large reservoirs on both ephemeral and permanent streams would be allowed by this permit, restricted only by the presence of wetlands and the need to collect excess water produced by oil & gas production wells.

As we indicated in our March 30, 1999 letter EPA believes it is inappropriate to destroy native aquatic communities with reservoirs, particularly for the purposes of oil and gas development. During our debate concerning the Wyoming Wildlife Habitat Projects general permit (GP 97-01) there was much discussion about the necessity to modify native habitat for wildlife purposes. At the conclusion of those discussions it was agreed by the agencies present that the wildlife habitat general permit was for purposes of restoration of degraded habitats, not



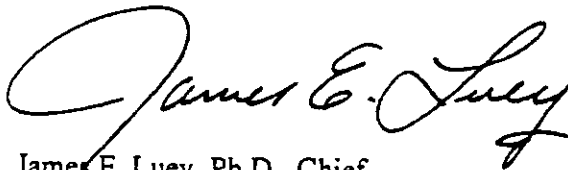
to modify existing native aquatic resources. It was recognized by the agencies that restoration of a degraded stream does not include construction of a reservoir as that would not restore the natural hydrology. In this case, the current proposal is to develop reservoirs on existing streams, with no indication that the stream is degraded, potentially no size limit for the reservoir, and no requirement that the reservoir be managed for habitat restoration purposes. The stated purpose is to collect excess water. Clearly, this could result in more than minimal impacts to water of the U.S. particularly in the cumulative context. We want to reiterate that our March 30, 1999 comments still apply to the reservoir construction activity being proposed, and we believe the current proposal is potentially much more damaging than that contained in the March 3, 1999 public notice.

The mitigation condition of the current proposal has also changed significantly from the previous version. The first sentence indicates that all projects must avoid and minimize impacts to wetlands. We strongly support this statement and suggest that it be moved to the front of the permit conditions so that it is obvious, as well as added to the discussion of the basis of the permit to show that, where possible, impacts to waters of the U.S., to include wetlands, must be avoided. This would greatly strengthen the general permit and improve the ability of the permit to assure that future impacts would be minimal. As you are aware, EPA does not believe it is necessary, particularly in the arid portions of Wyoming, to construct oil and gas development facilities, to include reservoirs to collect produced water, in waters of the U.S. in order to develop oil and gas. These facilities can be readily constructed in uplands.

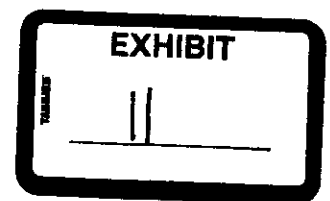
We also question the definition of "permanent" as used in the mitigation section. It is EPA's view that oil and gas development is "temporary" in nature, in that the wells have a useful life and can be plugged and the land restored at the end of that useful life. We recognize that the useful life may be in excess of 10 years and, should development occur in wetlands, the temporal loss of the resource for the life of the well is significant. Perhaps the mitigation section should require some type of mitigation bank to be developed for use only by the oil and gas industry to address these temporal concerns. In either case, the mitigation should require restoration of the resources to native conditions once the useful life of the development is attained.

Please provide this office a copy of the Corps evaluation conducted under 40 C.F.R. 230.7(b) for the final version of GP 88-02. At that time we will complete our 401 certification process for purposes of the Wind River Reservation. Thank you for the opportunity to comment at this time. If you have any questions on the above please contact Dave Ruiter at 303/312-6794.

Sincerely,



James E. Luey, Ph.D., Chief
Planning and Technical Unit
Ecosystems Protection Program





United States Department of the Interior
FISH AND WILDLIFE SERVICE

Ecological Services
4000 Airport Parkway
Cheyenne, Wyoming 82001



ES-61411

W.06 WY2514.mml (GP9803)

May 14, 1999

State Supervisor
U.S. Army Corps of Engineers
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Dear Mr. Bilodeau:

We have received Public Notice 199820008, regarding a proposal to issue a General Permit that would authorize oil and gas exploration, development, transportation, and distribution activities waters of the United States on private and public lands in Wyoming. These comments have been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

General Comments

Proposed General Permit 98-08 (GP 98-08) would authorize construction of roads, well pads, reservoirs, pipelines, activities to contain oil spills and cleanup of spills, and mitigation. Survey activities for oil and gas would also be authorized. Each single and complete project (generally all activities associated with development of a pad) could impact up to 1 acre of wetlands, and unlimited linear feet of streams (since there is no limit on linear feet of streams that could be impacted by reservoirs, spill containment/cleanup, and mitigation). There are no limits proposed for impacts to waters of the United States from pipeline construction. The Public Notice states that stockpiling of excess soil or unwanted vegetation in waters of the United States is not allowed outside "an approved impact area." However, it is unclear whether an approved impact area can be within waters of the United States.

Wetlands, and other waters of the United States in Wyoming are habitat for many endangered, threatened, proposed, petitioned and candidate species, such as: bald eagle, Colorado butterfly plant, grizzly bear, Kendall Warm Springs dace, Preble's meadow jumping mouse, Ute ladies'-tresses, Wyoming toad, boreal toad, and Bonneville cutthroat trout. Moreover, while these types of areas occupy a minor proportion of the landscape in Wyoming, they provide some of the most important habitat to a wealth of other fish and wildlife as well. An estimated 38% of Wyoming's original wetland acreage has been lost (U.S. Fish and Wildlife Service 1990). This, combined with their extremely high value to fish and wildlife, means it is critically important that impacts to such areas authorized via general permits are truly minor on an individual and cumulative

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basis. Fortunately, since wetlands make up only about 2% of the surface area of the State (U.S. Fish and Wildlife Service 1990) there are ample opportunities for avoiding these areas.

Impacts

General permits may be used to authorize activities that are similar in nature and cause only minimal individual and cumulative environmental impacts. The proposed GP 98-08 does not appear to meet either of these criteria. We do not believe that construction of roads, for example, is similar in nature to reservoir construction. More importantly, GP 98-08 has a high potential for authorizing projects that would cause significant cumulative impacts to waters of the United States - impacts that could far exceed the minor impact limit necessary mandated for issuance of a general permit. The Public Notice does not provide information relative to the anticipated impacts to waters of the United States from activities that would be authorized by the proposed general permit. However, our review of environmental impact statements, Records of Decision, and scoping statements for the Continental Divide/Wamsutter II, Fontanelle, Pinedale Anticline, Moxa Arch, and Jonah II projects revealed the following anticipated levels of oil and gas-related development:

- 10,496 new wells proposed;
- 3,604 miles of roads; and
- 3,478 miles of pipelines.
- In the Continental Divide/Wamsutter II analysis area alone, there would be an estimated 100 acres of wetland impacted in an area where wetlands are already scarce.

The figures above include only those impacts from the large oil and gas development areas; they do not include small operators, and many smaller areas such as Stagecoach Draw, Big Piney/Labarge, or any area outside of southwest Wyoming. Considering the high level of oil and gas resource development anticipated in Wyoming, as evidenced by the above figures, we believe GP 98-08 would likely cause much more than minor cumulative impacts to wetlands and other waters of the United States.

In addition to the quantity of wetlands and other waters that could be lost if GP 98-08 is authorized, we have serious concerns about impacts to water quality, and thus fish and wildlife, resulting from activities under proposed GP 98-08. The construction of well pads in wetlands would increase the risk of oil spills entering surface waters, damaging wetlands, and injuring wildlife.

The GP 98-08 would allow the construction of impoundments for the collection of oil field produced water in up to 0.33 acres of wetland. This is contrary to the Wyoming Oil and Gas Conservation Commission's regulation which prohibits the construction of pits of any kind in drainages, or in the flood plain of a flowing or intermittent stream, or in an area where there is standing water during any portion of the year. Oil field produced water impoundments often

contain significant amounts of oil. Field inspections of produced water impoundments in Wyoming and elsewhere in the western United States by Service personnel have documented wildlife mortalities in produced water impoundments or pits containing oil. Additionally, poor maintenance of these impoundments can and does result in spills, especially if there is very little freeboard on the impoundment. According to the U.S. Environmental Protection Agency's Emergency Response Notification System (ERNS) there were 4,576 produced water spills reported to ERNS in Wyoming in 1998; of these approximately 75% affected surface waters. The location of produced water impoundments on a wetland would be ill-advised given the potential liability to the operator under the Migratory Bird Treaty Act for migratory bird mortalities, the Oil Pollution Act for oil spills and Section 7003 of the Resource Conservation and Recovery Act for imminent and substantial endangerment of the environment.

Birds may have trouble distinguishing pristine wetlands from small pits, ponds and reservoirs containing oil. Waterfowl and other aquatic birds may be attracted to pits and open tanks used to store and separate oil from produced water. The pits also can attract hawks, owls, songbirds, bats, insects, small mammals, and big game. Songbirds and mammals may approach oil-covered pits and ponds to drink, and can fall into the pits, or they can become entrapped if the banks of the pits are oiled. Insects entrapped in the oil can also attract songbirds, bats, and small mammals. Hawks and owls in turn become victims when they are attracted by struggling birds or small mammals. In Wyoming, Fish and Wildlife Service (Service) personnel have found waterfowl, songbirds, bats, pronghorn, and deer in oil pits and tanks.

Produced water impoundments in or immediately adjacent to a wetland would only increase the risk of wildlife and migratory bird mortality. Oil waste pits are causing migratory bird mortalities in Wyoming. An estimated 2 million waterfowl are lost each year to oil pits throughout the United States. Birds are attracted to oil pits by mistaking them for natural bodies of water. The sticky nature of oil entraps birds in the pits and they die from exposure and exhaustion. Birds that do manage to escape can die from starvation or the toxic effects of oil ingested during preening. Birds ingesting sublethal doses of oil can experience impaired reproduction.

It is critical to avoid the presence of any oil or hydrocarbons on surface waters. Female aquatic birds returning to their nests with oil on their feathers can inadvertently apply the oil to the eggs. Microliter amounts of oil applied externally to eggs are extremely toxic to bird embryos.

The proposed general permit would require that all projects be designed to avoid impacts to wetlands, and to minimize impacts to wetlands that cannot be avoided. However, since notification of the Corps would not be required for projects affecting 0.33 acre or less of wetland, there will be no mechanism in place to ensure such impacts have in fact been avoided to the maximum extent practicable. Moreover, we do not believe that it is appropriate for the proposed GP 98-08 to authorize the construction of pads and reservoirs in wetlands, since such facilities can easily be located in uplands given the minute area wetlands occupy on the landscape, and given the flexibility for siting these features.

Proposed permit condition 1 defines a single and complete project for purposes of 98-08 as all activities undertaken in accordance with development of a single pad (excluding pipelines). We believe this definition promotes piecemeal development of large oil and gas fields and insufficient review of the total impacts to waters of the United States (and associated fish and wildlife) of large-scale oil and gas development. For example, the estimated impacts to 100 acres of wetlands in the Continental Divide/Wamsutter II area could be authorized, 0.33 acre at a time, without review by the Corps or resource agencies. Moreover, since impacts of up to 0.33 acre would require no compensatory mitigation, the entire 100 acres of wetlands could be lost without any compensatory mitigation. We do not believe this approach is consistent with the spirit and intent of section 404 of the Clean Water Act. This is only an example; large-scale development on private lands with private minerals would be even more problematic. We believe that oil and gas development activities should be permitted on a full-field basis (or one permit for each company proposing development within a field) using the individual permit process. This approach to addressing cumulative impacts would be akin to the approach now taken by the Corps when addressing subdivisions under Nationwide Permit 26 (i.e., cumulative impacts for an entire subdivision are considered when determining whether NWP 26 applies to avoid piecemeal development).

Mitigation

Proposed permit condition 16 regarding mitigation is also of concern to the Service on two levels. First, the proposed mitigation requirements are not sufficient to ensure that mitigation wetlands fully replace lost wetland acres and values in-kind. The requirements for in-kind and concurrent mitigation are excellent. However, we believe additional success criteria and monitoring requirements are necessary to ensure full wetland replacement. Mitigation success criteria should require replacement of the vegetative community of the lost wetlands, using species composition, cover, and diversity measurements from the impacted wetlands, or nearby reference wetlands. Success criteria should also include water depth and duration of flooding/saturation such that the hydrology of impacted wetlands is replicated. Monitoring should be conducted at least annually, with annual reports, until all success criteria are met. Finally, mitigation should be required for all permanent wetland impacts, as well as permanent impacts to other waters of the United States.

The proposed mitigation requirements also cause us concern because they are less stringent than those proposed for General Permit 97-01 (wildlife habitat projects) which is typically used for wetland restoration projects that increase wetland acres in Wyoming. For example, GP 97-01 would require mitigation for all wetlands filled - not just wetland impacts greater than 0.33 acres. In addition, GP 97-01 would require a post-project wetland delineation, photographs from established photo points, and information on fauna use. Inasmuch as GP 98-08 is intended to authorize projects that destroy wetlands, we believe that mitigation requirements should be at least as stringent as those required for GP 97-01 which is intended to authorize projects that move the nation towards our no net loss of wetlands goal.

Endangered Species Act Compliance

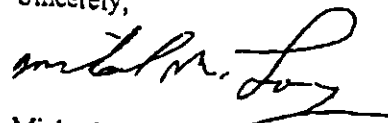
Pursuant to section 7 of the Endangered Species Act of 1973, as amended, and its implementing regulations, Federal agencies are required to consult with the Fish and Wildlife Service if their actions may affect a listed species. The Public Notice does not include the determination of the Corps as to whether issuance of the GP 98-08 may affect a listed species. The determination of whether issuance of GP 98-08 may affect listed species is the responsibility of the Corps. However, given the huge geographic scope of the proposed GP, the high level of impacts to waters of the U.S. which could be authorized under the GP, and the association of several listed and proposed species in Wyoming with waters of the U.S., we believe listed species may be affected by activities authorized under GP 98-08 and recommend the Corps initiate informal consultation with this office pursuant to section 7 of the Endangered Species Act if further consideration is given to issuance of this permit.

Recommendations

Issuance of GP 98-08 would: 1) likely result in significant cumulative impacts to wetlands and other waters of the U.S.; 2) not meet the minor impact criterion for issuance of a General Permit; 3) authorize significant impacts that are mostly avoidable; 4) have significant adverse impacts on fish and wildlife resources; 5) promote piecemeal evaluation and development of oil and gas facilities in waters of the U.S.; 6) not provide adequate mitigation for authorized losses of wetlands and other waters of the U.S.; and 6) potentially have negative effects on listed species. For these reasons, we recommend the Corps not issue GP 98-08 as currently proposed.

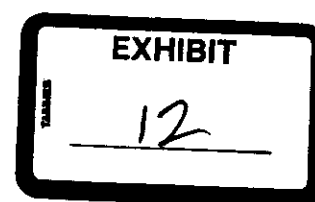
The above views and recommendation constitute the report of the Department of the Interior on this Public Notice. Thank you for coordinating with this office. If you have any questions about this matter, please contact me at the letterhead address or phone 772-2374, ext. 34.

Sincerely,



Michael M. Long
Field Supervisor
Wyoming Field Office

cc: Director, WCFD, Cheyenne, WY
Non-game Coordinator, Lander, WY
M. Hogan, FWS, Lander, WY
D. Ruiter, EPA, Denver, CO
State Director, BLM, Cheyenne, WY (Attn: R. Schuler)
D. Buechler, FWS, Lakewood, CO



WYOMING
GAME AND FISH DEPARTMENT



"Conserving Wildlife — Serving People"

May 14, 1999

WER 9302
U.S. Corps of Engineers
Public Notice/199820008
General Permit 98-08
Oil and Gas Activities

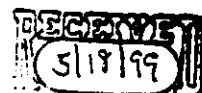
Thomas Johnson
Project Manager
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, WY 82009-4942

Dear Mr. Johnson:

The staff of the Wyoming Game and Fish Department has reviewed public notice 199820008, proposal to issue General Permit 98-08 (GP 98-08). While we support many of the changes made since the earlier draft of this permit, we have some concerns with the proposed GP98-08 (revised). We offer the following comments for your consideration pursuant to Section 404 of the Clean Water Act.

1. The current draft permit would allow reservoir construction on any stream type (perennial, intermittent or ephemeral). We strongly oppose this. Development of reservoirs on natural stream courses could severely impact native aquatic species and their habitats. We believe no reservoirs should be allowed on any stream course unless approved by this Department as providing benefits to fish and wildlife resources.
2. Permit Condition 1 defines a "single project" as all activities associated with development of a single pad, including roads and reservoirs, but excluding pipeline construction. Under the General Permit, this "single project" can impact up to one acre. However, oil and gas exploration and development could conceivably result in dozens or even hundreds of "single projects" over time, each one with an allowable wetland impact of one acre. Though the Corps reserves the right to define a "single project" on a case-by-case basis, there should be definitive criteria for when cumulative impacts of field exploration and development exceed the purpose and intent of this general permit.
3. We are unsure of how the Corps interprets the term "permanent" in relation to impacts (Permit Condition 1). Permit Condition 16 provides some clarification. However, since

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Mr. Thomas Johnson
May 14, 1999
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there is apparently no limit on how many acres can be "temporarily" impacted, we believe further clarification of terminology is appropriate.

Thank you for the opportunity to comment.

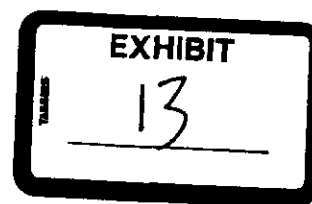
Sincerely,

A handwritten signature in cursive script that reads "Tom Collins" with a small "for" written underneath it.

BILL WICHERS
DEPUTY DIRECTOR

BW:TC:as

cc: Julie Hamilton-State Clearinghouse
Bill DiRienzo-DEQ/WQD
Dave Ruiter-EPA
USFWS

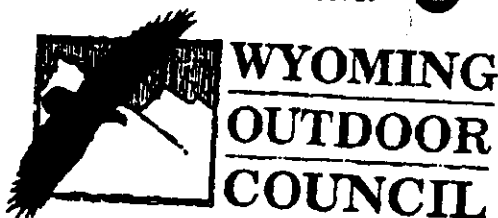


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262 Lincoln Street, Lander, Wyoming 82520
(307) 332-7031 — woc@rmisp.com

March 31, 1999

Mr. Thomas Johnson
U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, WY 82009-4942

Re: Comments of the Wyoming Outdoor Council on Proposed General Permit 98-08;
Request for Extension of Comment Period and for Informal Public Hearing

VIA FACSIMILE (307) 772-2920 AND U.S. MAIL

Dear Mr. Johnson:

On behalf of the more than 1000 members of the Wyoming Outdoor Council (WOC), we submit the following comments in response to a notice published in a U.S. Army Corps Engineers (Corps) March 3rd Joint Public Notice Memorandum (Application #199820008) with the Wyoming Department of Environmental Quality (WDEQ) and the U.S. Environmental Protection Agency (EPA). In the notice, the Corps proposes to issue General Permit 98-08 (GP 98-08) to authorize certain oil and gas development and exploration activities in wetlands and waterbodies on private and public lands throughout Wyoming.

WOC opposes the issuance of this permit in its current form as it fails to match the Administration's commitment to maintain a strong Clean Water Act and to protect the nation's wetlands and potentially violates the National Environmental Policy Act and Wyoming's antidegradation standards. Furthermore, the environmental analysis underlying the proposal is so cursory that it is difficult to understand or comment upon the likely environmental impacts of this permit.

WOC requests that the Corps extend the comment period for at least an additional 30 days, prepare a full Environmental Assessment (EA) to determine whether or not an Environmental Impact Statement (EIS) is necessary, and hold an informal public meeting to allow citizens to express their concerns regarding this issue. The comment extension is needed to address, among other things, the evaluation required by 40CFR 230(b)(3), absent in the proposed permit.

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While we realize that a replacement permit will be necessary in Wyoming to authorize some of the activities currently allowed under the expiring Nationwide Permit 26, we believe that there are still many ambiguities in the proposed GP 98-08 that need to be addressed. Many of the details of GP 98-08 outlined in the

Wyoming Conservation Action Since 1967

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Public Notice have yet to be worked out and many of the same problems which have alarmed so many conservationists regarding NWP 26 still exist. We believe that over the next few months, there exists a real opportunity to strengthen this permit through careful definition of terms and clarification of certain activities. The Corps must carefully rework the details of this permit to ensure that no more than minimal adverse environmental impacts result from activities authorized under its auspices.

General Concerns.

1) Lack of Compliance with the National Environmental Policy Act.

Under NEPA, the Corps is required to prepare an EIS for every Corps action likely to significantly affect the "quality of the human environment." 42 U.S.C. §4332. The regulations implementing NEPA define "major Federal actions" to include the adoption of official policy and the approval of specific projects, including "actions approved by permit." 40 C.F.R. §1508.18. These regulations require an agency proposing a major federal action to conduct an Environmental Assessment to determine if an EIS is necessary because the action will have significant environmental effects or, in the alternative, if a "finding of no significant impact," is warranted. 40 C.F.R. §1501.4.

The guidelines published by the Council on Environmental Quality (CEQ) clarify that the phrase "significantly affecting the quality of the human environment" is to be construed by agencies with a view to the "overall, cumulative impact of the action" and that in all cases an EIS should be prepared if "it is reasonable to anticipate a cumulatively significant impact on the environment." CEQ guidelines further state that actions which are "likely to be highly controversial, should be covered in all cases." 38 Fed. Reg. §20551. Also, the implementing regulations explain that the degree to which an action may "adversely affect an endangered or threatened species or its habitat has been determined to be critical" in determining whether an agency action "significantly" effects the environment. 40 C.F.R. §1508.27.

In compliance with NEPA, the Corps should conduct an environmental assessment to determine whether or not this permit's issuance would warrant an EIS and hold an informal public meeting to further discuss this matter. (For many of our members living in/near riparian areas slated for oil and gas development, in their eyes we are sure that this permit would significantly affect their quality of life and environment. Although there are many communities throughout Wyoming which will be effected, two of the most likely candidates are Pinedale and Gillette.)

WOC would like to emphasize that accurate and up to date data is currently unavailable regarding the presence of wetlands throughout the state of Wyoming. Some of the most current data available was collected by the USFWS in waterfowl

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surveys conducted in the 1950s and in the late 1980s by T.E. Dahl. Indeed, as this geographical/biological data is currently incomplete and it is unclear exactly how many projects will be proposed under this, how can the Corps determine whether or not this would constitute a "major action" or not? According to the BLM, as many as 250 oil and gas well pads and associated structures may be constructed in waters of the U.S. just around Pinedale alone! As this permit allows for the destruction of .33 acres without mitigation, it could lead to the impact of over 80 acres of wetlands and waters of the U.S. within this relatively small geographic area. Approximately 15,000 wells have been proposed on federal lands throughout the state, not including the 5000+ wells which may be developed in northeast Wyoming for coal bed methane development! Even with the ambiguities of the situation, these figures alone suggest that this permit would result in major cumulative environmental impacts to waters of the U.S. The destruction of two acres of wetlands alone can be argued as an action of great significance, particularly in the arid west where water is scarce and wetlands habitat uncommon.

Field data indicates that wetlands in arid and semiarid areas are used much more extensively by wildlife than wetlands in more humid climates where wetlands are more abundant (Ratti, J.T., and Kadleck, J.A. 1992. Concept Plan for the Preservation of Wetland Habitat of the Intermountain West, North American Waterfowl Management Plan, U.S. Fish and Wildlife Service Region 1, Portland, Oregon). It has been further argued by Ratti and Kadleck and others that such small, ecologically significant wetlands are increased in value by their scarcity and therefore deserve the strongest possible protections. Due to wetlands' relative scarcity throughout our state, the stakes are much higher for the state of Wyoming when it comes to the conservation of this resource. The implications regarding the health of our state's wetlands and riparian areas will have significant ramifications for the future of our state's wildlife, water quality and community quality of life. (See section on wetlands values below)

2) Lack of Compliance with Clean Water Act section 404 (e)

Section 404(e) of the Clean Water Act authorizes that the Corps issue general permits on a nationwide basis for discharges of dredged or fill material that have a minimal adverse environmental impact, either individually or cumulatively. Specifically, section 404 (e) states:

"[T]he Secretary [of the Army] may, after notice and opportunity for public hearing, issue general permits on a State, regional, or nationwide basis for any category of activities involving discharges of dredged or fill material if the Secretary determines that the activities in such category are similar in nature, will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effects on the environment." 33 U.S.C. §1344(e)

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As previously stated, the Corps has failed to prove that this permit would not authorize minimal adverse environmental impacts, either individually or cumulatively. It is WOC's recommendation that the Corps conduct a thorough EA to determine this permit's compliance with Section 404 (e) of the Clean Water Act.

Although it is difficult to assess GP 93-08's impacts on Wyoming water quality, there are certainly obvious questions (such as the proposed use of stockpiling in waters of the U.S.) regarding this permit's compliance with Section 401 of the Clean Water Act.

3) Values of Wetlands/Potential Threats to Wyoming's Wetlands

Wildlife Habitat

Although wetlands cover only approximately 2% of the state (Dahl, T.E. 1990. Wetlands Losses in the United States 1780s to 1980s. U.S. Fish and Wildlife Service, Washington, DC), their ecological and economic values are tremendous. Wetlands are arguably the most diverse ecosystems in Wyoming. About 90% of the State's wildlife use wetlands daily (University of Wyoming, 1990) and their health is crucial for the tremendous numbers of waterfowl and other migrants using the Central Flyway. An estimated 43% of threatened and endangered species are dependent on wetlands for survival and freshwater fish depend on wetlands either directly for food, habitat or breeding at some point in their lifecycles, or indirectly by consuming prey which are wetland dependent. Wyoming's wetlands are the key to the sustainability of many of the state's lucrative outdoor recreational activities such as hunting, fishing, rafting, backpacking and wildlife viewing. The health of the environment, especially wetlands, will be exceedingly important for Wyoming to maintain a sustainable and successful tourism industry.

Fisheries/Tourism

According to the American Sportfishing Association, every year sportfishing brings in an estimated \$212,421,000 to Wyoming's economy and sustains nearly 3900 jobs (Compendium of Sportfishing Statistics, American Sportfishing Association, June 1996). Also, according to a 1997 study conducted by the Wyoming Division of Tourism, travel related industry brings in nearly \$1.4 billion annually and provides nearly 50,000 full and part-time jobs throughout the state. In addition, wetlands provide essential water and forage for Wyoming's significant numbers of livestock, another important industry.

Unfortunately, Wyoming has lost approximately 38% of its wetlands to agriculture and development (Dahl, 1990). Although there have been some mitigation efforts throughout the state and some habitat has been created by the formation of stock ponds and mining pits, it has yet to be demonstrated that the overall diversity and values of natural wetlands can be rivaled by cultural wetlands. And, indeed there are many wetlands throughout the State which have not been delineated due to

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their small size. However, these wetlands are ecologically significant as they are often the only source of water within the area. During years of drought, these areas will be oases for wildlife and livestock alike.

GP 98-08 is of particular concern to WOC due to its potential for damaging isolated and headwater wetlands in areas proposed for oil and gas development. In its 1995 report *Wetlands: Characteristics and Boundaries*, the National Academy of Sciences found that the "scientific basis for special permitting of wetlands in headwaters or isolated waters is very weak." In addition, the Corps has recognized the value of these areas as they "often play an ecological role that is as important as other types of wetlands in protecting water quality, reducing flood flows, and providing habitat for many species of fish and wildlife." 33 U.S.C. 1344(e). While WOC applauds the Corps' decision to phase out NWP 26 and alleviate the damages to such fragile wetlands areas, there is little assurance in the public notice that isolated and headwater wetlands will be protected.

4. Potential Threats to Wyoming Waters/Violations of Wyoming's Antidegradation Standards

GP 98-08 could potentially allow the discharge of dredge material (especially through stockpiling) into or around class 1 waters and other "outstanding national resource waters". This is inappropriate. Nowhere in the public notice is mentioned the need for the Corps to manage these waters under a strict anti-degradation policy as required by the Clean Water Act. 40 CFR 131.12. This must be clarified. Under Wyoming's antidegradation policy, new or increased sources of pollution that would lower the water quality in class 1 waters and outstanding national resource waters are not permitted. For tier 3 waters, federal water quality standards mandate that the Corps "maintain and protect high quality waters that constitute an outstanding national resource, such as waters of national and state parks and wildlife refuges and waters of exceptional recreational or ecological significance." 40 CFR § 131.12. Class 1 waters such as the Green River and the Snake are regarded as the "jewels" of our river system and the maintenance of their health and integrity are crucial.

Similarly, there is no mention in the public notice for the Corps to follow antidegradation policies for class 2 waters. This should also be clarified. As federal regulations dictate, the Corps must "maintain and protect existing water quality, where such existing water quality exceeds levels necessary to support propagation of fish, shellfish, wildlife and recreation in and on the water, unless the state finds that certain conditions are satisfied. A key finding which must be made is that allowing lower water quality is necessary because reasonable non-degrading or less-degrading alternatives are not available." 40 CFR §131.12. As the Corps is aware, the most significant function of these tier 2 requirements is to ensure that all other alternatives have been evaluated (i.e.: source elimination, reduction

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options etc...) before allowing for the discharge of dredge materials into a waterbody. This evaluation must demonstrate that the proposed water quality degradation is necessary because all other non-degrading or less degrading alternatives are not available.

Furthermore, WOC firmly believes that it is not sufficient to protect critical wetlands habitats associated with high quality waters. Not only should wetlands associated with class 1 waters and "study rivers" be given the strongest possible protections, but any wetlands or wetland complexes that function as important reservoirs of biodiversity, including those areas which are of national importance to breeding, wintering or migrating birds and other wildlife/or areas that can not be replaced by current mitigation techniques.

5. Critical Resource Waters Must Be Designated and Protected

WOC fully supports the recent recommendation of national conservation groups regarding the designation of "Critical Resource Waters". This process could be set up in coordination with the U.S. Fish and Wildlife Service, the U.S. Geological Service and other federal/state agencies, universities, non-profit organizations, and interested citizens by which "Critical Resource Waters" are protected. By excluding the use of GP98-08 and other general permits in such areas, the Corps will be able to ensure that no more than minimal adverse environmental impacts are attained in such areas of concern.

Such "Critical Resource Waters" could include: habitat for threatened and endangered species, all streams used by anadromous fish species and their associate headwater wetlands and tributaries, all wetland types that are rare and/or can not be replaced through mitigation (i.e.:), all waters with three miles of National Parks or National Wildlife Refuges and source waters for public drinking water supplies.

We further propose that a formal process be created by which Critical Resource Waters are designated. This process should be coordinated by the U.S. Fish and Wildlife Service, in cooperation with the U.S. Geological Service, other federal agencies, universities, non-profit conservation organizations, and interested citizens. Some initial examples that WOC proposes for designation as Critical Resource Waters include:

-Habitat for threatened or endangered species. Any waters that serve as migratory, wintering, or breeding habitat for federal or state threatened or endangered species should not be subject to un-reviewed permitting.

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-All streams used by Salmonids, other anadromous fish species, and their associated wetlands and upstream tributaries. Federal, state, and private entities have made, and continue to make significant investments in protection and restoration of trout and salmon spawning streams. For example, one species currently under consideration for listing is the Yellowstone Cutthroat trout. Allowing un-reviewed destruction under GP 98-08 to further degrade these systems undermines this large public investment and puts at risk the future of many species of cold water and anadromous fish species, including the Yellowstone Cutthroat and others.

-All High Quality (Tier 2 under Water Quality Standards) Waters. High Quality Waters that fully support aquatic life uses deserve protection against degradation. The diversity of aquatic invertebrates, mollusks, and other species found in these systems may be impossible to replace if lost due to degradation of water quality and/or loss of habitat.

-All wetland types that are rare and/or cannot be replaced through mitigation. This should include (but not necessarily be limited to): bogs, fens, alpine and subalpine meadows, mature forested wetlands, vernal pools and marshes, and wet prairies. Protection of irreplaceable and/or fast-disappearing habitat types is imperative to prevent a net loss of biodiversity.

-All waters within three miles of a National Wildlife Refuge or National Park. These federally-protected lands provide some of the most valuable habitats and reservoirs for biodiversity in the country. Activities that occur outside park or refuge boundaries can have a profound effect on the area's viability. Such impacts should be fully reviewed and the public and the land management agency should be allowed to comment on how these activities will effect the areas they manage.

-Source Waters for Public Drinking Water Supplies and Aquifer Re-charge Wetlands. Destruction of these areas can put public drinking water supplies at risk. It is critical, therefore that local governments and concerned citizens have a right to comment on such proposed impacts.

WOC hopes that the Corps will consider integrating this significant and timely proposal into their wetlands management policies.

6) Potential Threats to Threatened and Endangered Species

While WOC supports the Corps' promise not to authorize any activity which would violate the Endangered Species Act and to coordinate with the USFWS and other

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relevant agencies, we are concerned that GP 98-08 may still pose a threat to threatened plants and wildlife through its operating procedures. It is our understanding that the Corps has, in the past, often allowed the applicant to determine whether or not any threatened or endangered species inhabit the wetland which the applicant seeks to fill. This process, if it is the case, poses obvious threats to threatened species and puts the Corps in the uncomfortable and unnecessary position of failing to fulfill its responsibility under the ESA to protect threatened and endangered species.

The Corps must be determined in its efforts to continue coordinating with the U.S. Fish and Wildlife Service regarding the implementation of this and other general permits. To alleviate the substantial workload which the Corps now bears, WOC recommends that the Corps seek greater assistance from other federal resource agencies in protecting threatened and endangered species. Such efforts will be vital during the coming months with the ongoing development of habitat conservation plans for riparian dependent species such as the Preble's Jumping Mouse and the continued preservation of other wetland dependent/associated species such as the least tern, the bald eagle, the whooping crane, the Kendall Springs dace, the Wyoming Toad, the Ute Ladies Tresses plant; potentially existing endangered species such as the Colorado squawfish, the humpback chub and the bonytail chub, and for candidate species for listing/species of concern such as the Colorado butterfly plant, the boreal toad (southern Rockies population), the spotted frog and the sturgeon chub.

7) Workload

While WOC sympathizes with the Corps regarding the increasing strains of the permitting system on the agency, workload is not a relevant factor when determining whether or not to issue new general permits. There have been political rumblings that the Corps must streamline its permitting process to facilitate the development of oil and gas deposits on Wyoming lands. This is unfortunate and not helpful. Given the Corps' insufficient funding and staff levels, this sort of political pressure from state and federal entities is not warranted. There have also been comments that this permit will be needed due to the heavy workload which has been imposed on the agency.

However, the Clean Water Act authorizes the Corps to issue general permits to cover only "similar" activities which have only "minimal" impacts upon the environment. The law does not authorize the Corps to issue destructive permits such as GP 98-08 in an attempt to alleviate the substantial workload which would be necessitated by the processing of too many individual permits. WOC concedes that workload is a legitimate and important concern for the Corps, but the Clean Water Act does not authorize the issuance of general permits to address workload

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concerns. The agency should explore options to address its workload concerns which are consistent with the requirements outlined in the Clean Water Act.

Specific Concerns

1) Mitigation

With the increasing trend in the United States to use mitigation as a wetlands management tool, as well as the increasing trend of "mitigation banking", the Wyoming Outdoor Council is extremely concerned about this particular aspect of the permit as well as future decisions that the Corps may make with regards to its use/enforcement. As the Corps understands all too well, the ramifications of this practice regarding wildlife habitat and water quality are huge. It is our hope that the Corps will comply with §404(b)(1) guidelines calling for "sequencing" (requiring that impacts to wetlands be avoided when practicable and if necessary, ensure that impacts are minimized to the greatest extent possible) and that only after all other alternatives have been considered, turn to the option of mitigation.

Although there have been very few studies on the long term efficacy of mitigation (especially in the Rocky Mountain Region), its track record suggests that there is substantial room for improvement. For instance, over half of the of the mitigation projects investigated in Florida were deemed incomplete or failures. Another one in California discovered that fewer than one third of 387 wetlands were monitored even once to determine whether or not they were in compliance with regulations. (Ecological Society of America News, April 5, 1996, Ecologists Identify Problem Areas in Wetland Mitigation). And according to a USFWS study in Colorado, it was decided that "there is the more general question of whether wetlands that are restored or created adequately compensate for wetland functions and values that are lost or diminished." (USFWS, Wetland Losses Within Northern California from Projects Authorized Under Nationwide Permit 26 (1992)).

While strides are being made with mitigation as a wetlands management tool, it is still all too obvious that man-made wetlands are almost always less valuable than existing natural habitat. Referencing a USFWS study conducted by D.J. Cooper, the EPA stated in an Informal Region VIII Guidance Concerning the February 7, 1990 EPA/CORPS Mitigation MOA (Draft March 29, 1999 version): "[I]n all likelihood, mitigation wetlands do not fully replace all the functions of a lost wetland. This would undoubtedly be the case when replacement of unique wetlands is considered. For example, it is difficult to imagine creation of similar functions that exist in a wet meadow in Rocky Mountain National Park. The combination of precipitation and temperature extremes, geological substrate, complex surface and groundwater interactions, vegetative see sources, etc...is overwhelming" (Informal Region VIII Guidance Concerning the February 7, 1990 EPA/Corps Mitigation MOA, Cooper, D.J. 1990. Ecology of Wetlands in Big Meadows, Rocky Mountain National Park,

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Colorado. USFWS, Biological Report 90 (15). The report further states: "[T]he basic assumption that an acre of mitigation wetland can replace the wildlife functions lost from a similar acre must stand alone. Given the 'state of the art' available for water, soil and vegetation manipulation, it is highly unlikely that man can create "exactly" the same wetland functions which would be lost. Region VIII has no evidence that this has occurred in the past."

According to Dr. Joy Zedler of San Diego University who convened a forum on mitigation banking in 1996, the only way that mitigation can be successful is by "providing a habitat that is functionally equivalent to the one that will be lost" and urges that one wetland type not be replaced by another (Ecological Society of America News, April 5, 1996, Ecologists Identify Problem Areas in Wetland Mitigation).

While we are heartened to hear that the Corps will not consider wetlands "preservation" as mitigation, WOC believes that the replacement ratio of 1:1 is inadequate. To comply with the Administration's Clean Water Initiative which calls for the net increase of 100,000 acres of wetlands by the year 2005 and for the Corps to increase by at least 50% the wetlands restored and enhanced through its programs, the Corps obviously must increase the replacement ratio suggested under this permit. Faced with the grim reality that the nation already is losing approximately 100,000 acres of wetlands annually, GP 98-01 should authorize a more substantial replacement ratio than 1:1. A higher mitigation ratio would also give us a better chance of encompassing more of the functions and values of a mitigated wetland.

Different studies have suggested using ratios ranging from 2:1 (in Ohio) to as high as 10:1 (in Washington) depending on the wetland type in question and the various ecological conditions of the site. According to the February 7, 1990 EPA/Corps Mitigation MOA, mitigation ratios are recommended to be (for non reservoir projects) adjusted upward (2:1, 4:1, 6:1) to address non-habitat wetland functions and be considered on a case by case basis. Regarding the habitat functions, an assessment may be conducted of both the impacted wetlands and the mitigation area. However, it must be kept in mind that "[W]hatever ratios are used, the major emphasis should be placed on ensuring that the mitigation plan will replace the wetland habitat functions that would be lost to the degree necessary to ensure at a minimum, the maintenance of the physical, chemical and biological integrity of the Nation's waters occurs. Given the Clean Water Act's goals, it may be appropriate to consider increased ratios with the ultimate goal of restoring the nation's waters. This could be particularly useful when other federally-mandated projects are involved since all the federal agencies are pursuing a no-net-loss goal." (Informal Region VIII Guidance Concerning the February 7, 1990 EPA/Corps Mitigation MOA).

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In light of these recommendations, WOC asks that the Corps consider a mitigation ratio at a minimum of 2:1 and for the agency to assess each project on a case by case basis.

We commend the Corps for its proposed preference of engaging in "in-kind" and "on-site" mitigation. It is prudent and complies with the above referenced 1990 EPA/CORPS Mitigation MOA.

As Wyoming's population grows over the coming years and development and pollution pressures increase on our land surface, there will be a greater need to protect our remaining wetlands as well as to successfully mitigate for the habitat/water quality losses incurred. Mitigation will be a key component in the future of this state's wetlands and riparian areas. WOC would be very willing and extremely interested in working with the Corps on the many aspects of this highly complicated and important issue.

2) Stockpiling

WOC is very concerned about this activity being authorized under this permit. While the Corps rightly recommends not stockpiling in flowing or standing water, is the agency recommending that stockpiled material be placed near standing or flowing water? If so, how close? And what sorts of habitats would be acceptable to stockpile in? Ephemeral or seasonal wetlands? High elevation bogs? Willow thickets? Wet meadows?

The Corps should specify how far stockpiles would be allowed from flowing or standing water and clarify where stockpiling would be acceptable. The Corps should also require protective measures to be taken by the applicant to minimize runoff and drifting into wetlands and waterbodies, especially class 1 waters.

As mentioned above, this proposal could be in violation of Wyoming's water quality standards as mandated by the Clean Water Act.

3) Pipeline Construction

WOC is firmly opposed to this specific proposal. The fact that there is no limit on the area of wetlands that can be temporarily disturbed while laying pipes is very disturbing. The ramifications for extensive habitat destruction are only all too apparent.

The Corps should also take into account that different wetland habitats have different levels of resilience to disturbance. It is highly unlikely that Wyoming wetlands will be able to be restored to pre-project conditions. Restoration often has limited success.

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With regards to the 50 foot limit on disturbance in wetland areas, why did the Corps come up with this particular figure? Given the dimensions of most oil and gas pipelines, this proposal does seem to be extreme. The Corps should reconsider this particular aspect of the permit and come up with a more reasonable and realistic figure.

4) Springs

While WOC believes that the ban on activities within 100 feet of springs is prudent, we believe that the threshold is inadequate and should be raised. In its 1997 Green River Resource Management Plan Record of Decision, the Bureau of Land Management recommended that surface disturbing activities should not take place within 500 feet of water. WOC recommends that the Corps consider raising the 100 foot ban on activities to 500 feet to ensure consistency in federal resource management decisions (U.S. Department of the Interior, Record of Decision and Approved Resource Management Plan for the Green River Resource Area, (August, 1997)). This condition should apply to all lands, regardless of ownership.

5) Pad Construction

As current technology exists to construct drilling platforms outside or adjacent to wetlands (i.e.: directional drilling), it seems that the Corps should prohibit all pad construction in wetlands and waters of the U.S. The wording in the proposal indicates that the applicant does not have to make any effort whatsoever to avoid impacts to waters of the U.S. The Corps should clarify this glaring ambiguity and completely remove any well pad activity from the permit.

6) Road Construction

The .25 acre threshold called for in this proposal is too high and unnecessary. To alleviate this problem, the Corps could require that the road cross the stream at a right angle, thereby reducing environmental impacts. The Corps should also limit the width of the fill area to a strict minimum necessary for project completion. The Corps should also add a requirement that unnecessary roads and associated structures be removed after the life of the well has been exceeded, and that habitat restoration and enhancement projects for native species be initiated.

7) Reservoir Construction

The .50 acre threshold also called for in this proposal is also too high and unnecessary. The Corps should assess the water storage necessities of each project on a case by case basis. While coal bed methane production activities may require the construction of reservoir facilities for storage of excess water, it is not appropriate for the Corps to recommend a blanket threshold for all such activities throughout the State of Wyoming. The effects of released waters to downstream riparian biological communities may be adverse as will as the effects of decreased

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flows/existence of remaining reservoirs towards the project's completion. While the creation of deep water habitat may benefit some species such as waterfowl, it is unlikely to offset the loss of natural wetlands. The Corps should have a mitigation policy set in place for the loss of wetlands under this activity and a long term restoration and recovery plan for downstream aquatic communities. WOC opposes this activity in its current form and recommends that the Corps remove it from the proposal.

8) Public Participation and Notification Procedures

WOC believes that the public participation and notification procedures outlined in the permit are inadequate. Currently, under GP 98-08, the applicant is required to send a pre-construction notification just to the Corps. WOC recommends that all residents of the community in question should be mailed the same pre-construction notification and given at least 30 days to comment on it. Similarly, the public should be mailed a public notice regarding the Corps' anti-degradation conclusions and given 30 days to comment on aspects of the review which could possibly be improved. The substance of the public notice should be in compliance with the state's antidegradation standards.

WOC commends the Corps for recognizing the critical role that the public should play in the development of this general permit and for reviewing our concerns over GP 98-08. However, given the controversial nature of GP 98-08 and the many questions which have been raised regarding its content, we would ask for further opportunities for the public to participate in the development of this permit.

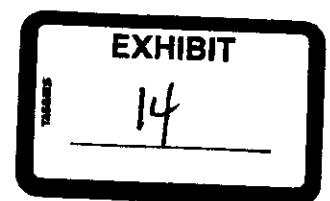
To reiterate, we respectfully request that the Corps extend the comment period for at least an additional 30 days, prepare a full Environmental Assessment (EA) to determine whether or not an Environmental Impact Statement (EIS) is necessary, and hold an informal public meeting to allow citizens to express their concerns regarding this issue.

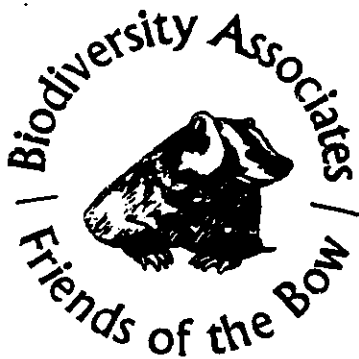
We look forward to working with you over the coming months on the development of this permit and appreciate the opportunity to submit these comments on this important and timely issue. Please let us know how we can further help you. Thank you for your consideration.

Sincerely,


Dan Heilig
Executive Director


Mac Blewer
Program Associate





Working to Protect Native Species and Their Habitats

P.O. Box 6032, Laramie, WY 82073 (307) 742-7978 fax: (307) 742-7989

May 14, 1999

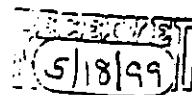
U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Blvd., Suite 210
Cheyenne, WY 82009-4942

The following are our comments on the proposal by the Omaha District of the U.S. Army Corps of Engineers (ACOE) to issue General Permit 98-08 (GP 98-08). This proposal was first announced to us in an April 14, 1999 Public Notice and is jointly proposed by the ACOE, the U.S. Environmental Protection Agency (EPA), and the Wyoming Department of Environmental Quality.

Biodiversity Associates is a non-profit organization dedicated to protecting and restoring native biological diversity, with a focus on the forests, waters, and prairies in Wyoming and surrounding states. Friends of the Bow is an unincorporated organization dedicated to protecting the ecosystems encompassing the Medicine Bow National Forest and Thunder Basin National Grassland in Wyoming.

We are gravely concerned about impacts to wetlands and waterbodies in the state. Water is the life blood of Wyoming; it is a limiting resource for the population sizes and distributions of most wildlife species. Unfortunately, there are indications Wyoming's aquatic ecosystems are already in trouble. Based on our status reviews of biological diversity in Wyoming, over thirty species of fish native to Wyoming are rare and/or declining; over fifty species of critically imperilled plants in Wyoming are aquatic or riparian dependent;¹ and there are numerous birds, mammals, and amphibians also imperilled or declining as a result of impacts to aquatic ecosystems. These include the Least Tern, the Preble's Meadow Jumping Mouse, and the Wyoming Toad -- all federally listed under the Endangered Species Act. Along with our mailed version of these comments, we are enclosing descriptions of the aquatic-dependent species we have found to be in need of conservation attention. In light of the existing degradation and problems, we are opposed to activities which would further degrade Wyoming's aquatic ecosystems.

¹ These are the species listed as "S1" in the Wyoming Natural Diversity Database. Most of these species have not been considered for listing under the Endangered Species Act.



As proposed, GP 98-08 would authorize various kinds of impacts to wetlands and waterbodies caused by oil and gas exploration, development, transportation, and distribution activities in Wyoming. The activities would involve, among other things, the construction of roads, well pads, reservoirs, and pipelines, as well as activities associated with the clean-up of oil spills. As we understand it, GP 98-08 would act as a "programmatic permit" so that individual projects -- such as construction of a drill pad and access roads and catchment ponds and reservoirs -- would not be required to obtain a site-specific 404(b) permit under the federal Clean Water Act (CWA).

As discussed in the following pages, we have a number of objections to the proposed general permit and believe requiring individual project-specific 404(b) permits would better meet the spirit and letter of the Clean Water Act and implementing regulations. Thus, we ask the Corps to reconsider this proposal. In the event that ACOE decides a general permit may be appropriate despite our comments, we ask that an environmental impact statement (EIS) be prepared to fully assess the consequences that would result from the actions authorized under the permit.²

1. **Proposed general programmatic permit GP 98-08 would eliminate necessary and important regulatory controls and is therefore contrary to the Clean Water Act regulations.**

By definition, a general permit for a class of activities can only be issued where:

- (1) Those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts, or
- (2) The general permit would result in avoiding unnecessary duplication of the regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal."

33 CFR § 322.2(f) (emphasis added). All of the activities falling under the sweeping classification of "oil and gas exploration, development, transportation, and cleanup" cannot be considered "substantially similar in nature." Drilling localized wells and excavating catchment reservoirs are substantially different activities (in both scope

² We understand ACOE issued an earlier Public Notice on a slightly less restrictive version of GP 98-08. We appreciate the Corps' decision to extend the comment period. Since we were never sent a copy of this earlier proposal, the following comments only apply to the proposed version of the general permit provided with the April 15, 1999 Public Notice. To ensure we are not left out of the public process again, please make sure our organization is included on your mailing list to receive notices of similar proposals in the future.

and effect) from constructing access roads and installing pipelines across wide areas; and all of these activities are substantially different (in both scope and effect) from oil spill clean up activities. Thus, 33 CFR § 322.2(f)(1) (i.e., the first provision listed above) is inapplicable, and 33 CFR § 322.2(f)(2) (the second provision above) governs. This means the proposed general permit cannot be issued unless it would "avoid unnecessary duplication of regulatory control exercised by another Federal, state, or local agency."

The proposed general permit GP 98-08 would not avoid unnecessary duplication of regulatory control exercised by another Federal, state, or local agency. It would certainly reduce the ACOE's effort needed to issue 404 permits on a case-by-case basis for those activities. But the regulations do not provide for eliminating this type of regulatory control -- control exercised by the ACOE itself. The proposed general permit would not eliminate duplication of regulatory control exercised by any other agency because no other agency -- federal, state, or local -- conducts 404 reviews (or anything remotely similar) on the class of activities in question. The EPA has discretion to review aspects of CWA implementation and compliance, but ACOE is charged with administering 404 permits for discharges of dredged or fill material into waters and wetlands of the United States.

Furthermore, even if 33 CFR § 322.2(f)(2) did allow the ACOE to issue general programmatic permits where it would help ACOE avoid duplicating any of its own unnecessary regulatory controls, that is not what the proposed permit GP 98-08 would do. Instead, GP 98-08 would eliminate necessary and important ACOE regulatory controls on the activities in question.

(A) GP 98-08 would eliminate 404(b) factual determinations.

The purpose of the 404(b) regulations is to "restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." 40 CFR § 230.1(a). To achieve this purpose and determine whether a 404(b) permit should be issued for a particular project, the activity in question must undergo a rigorous 404(b) evaluation, subject to the criteria set forth in 40 CFR Part 230. See, e.g., 33 CFR § 325.2(a)(6). Among other things, the 404(b) evaluation is necessary to:

determine the potential short-term, long-term, cumulative, and secondary effects of the project's discharge, 40 CFR § 230.11, including impacts to the physical and chemical characteristics of the aquatic ecosystem, 40 CFR Part 230, Subpart C, impacts to the biological characteristics of the aquatic ecosystem, 40 CFR Part 230, Subpart D, impacts to special aquatic sites such as wetlands, 40 CFR Part 230, Subpart E, and impacts to human use characteristics such as degradation of aesthetics, "compositional harmony or unity, visual distinctiveness, or diversity of an area," 40 CFR Part 230, Subpart F;

determine whether the project's discharge would pose unacceptable impacts to elements of the aquatic environment and special aquatic sites, 40 CFR Part 231;

determine whether less damaging alternatives to the proposed discharge, 40 CFR § 230.10(a); and

determine whether the discharge from a particular project would be in the public interest.

Clearly, these determinations are needed to regulate activities and control their impacts. This is because different projects -- even if they are similar in nature -- would lead to different determinations. For example, one drill pad may be proposed on stable soils, in an area that already has signs of industrial development (e.g., roads), and discharge into a Class III water; performing a 404(b) evaluation would probably reveal no significant problems with this activity. Yet a very similar drill pad, proposed for construction on hydric soils (e.g., part of a riparian area), in a visually pristine area, with discharge into a Class I water might be found to be very problematic. Yet under GP 98-08, these two projects would be treated identically and would both be automatically qualify for the general 404 permit.

In short, GP 98-08 would eliminate the important regulatory control of project-specific 404(b) evaluations and determinations.

In the Public Notice on proposed GP 98-08, the ACOE states that:

"The decision whether to issue GP 98-08 will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activities on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. * * * All factors which may be relevant to the decision will be considered; [sic] including, water quality, wetlands, historic properties, fish and wildlife, flood plains, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production mineral needs, conservation, economics, aesthetics, considerations of property ownership and, in general, the needs and welfare of the public. In addition, the Corps evaluation will include application of the guidelines promulgated by the Administrator, U.S. Environmental Protection Agency, under the authority of Section 404(b) of the Clean Water Act of 1972 (40 CFR Part 230). The guidelines establish specific criteria for evaluating permits and the guidelines prohibit issuance of permits for discharges into special aquatic sites when there are less damaging practicable alternatives."

Public Notice, page 3. Thus, ACOE at least realizes the activities that would fall under GP 98-08 do require a thorough 404(b) evaluation. It is easy to say such a comprehensive evaluation will be done; it is a very different thing to actually perform one. Given the size of Wyoming and given the diversity of conditions which exist across the state, we believe it will be impossible for ACOE to properly apply and evaluate all of the 404(b) criteria for the entire spectrum of activities that may be authorized under GP 98-08. How, for example, will ACOE evaluate the impacts on "aesthetics" and "shoreline erosion" -- for each and every location in the entire state of Wyoming -- from all conceivable roads, drill pads, catchment reservoirs, pipelines, spill clean up activities, and seismic testing activities that might occur in the future? It can't be done. If ACOE thinks it can make such an evaluation, it must fully document how this will be done in the administrative record. This must include, among other things, a discussion of the assumptions, data, and methodology used to evaluate each factor.

(B) GP 98-08 would eliminate the regulatory control of project-specific environmental impact reviews.

According to 33 CFR § 325.2(a)(4), the ACOE is required to conduct a project-specific environmental impact review before issuing any 404(b) permit. Such reviews are essential to understanding the precise nature of the impacts posed by each project and to identifying less damaging alternatives for each project. Only by gathering this kind of information will it be possible to determine necessary regulatory restrictions on particular activities in particular areas. Under GP 98-08, however, such project-specific environmental reviews would presumably no longer be performed. Thus, GP 98-08 would eliminate the important regulatory control embodied in project-specific environmental reviews.

While the Public Notice is vague on this issue, it appears ACOE believes it can substitute a single programmatic environmental review (which has not been done), for all activities subject to GP 98-08, for individual project-specific reviews. However, given the great diversity of lands and resources that exist across Wyoming, and the wide variety of activities subject to proposed GP 98-08, we do not believe a single programmatic review is either practicable or appropriate. In our experience, programmatic environmental assessments are invariably generic and conclusory. Because of their scope, it is impossible for programmatic assessments to consider site-specific conditions such as soil types, slope, stream type, ecological value of waters and wetlands (all are important, but some are more important than others), and local hydrologic conditions (e.g., recharge). Thus, agencies generally use programmatic assessments to get a "big picture" overview of what kinds of impacts might occur and then use site-specific assessments to focus in on the precise nature of impacts posed by particular projects. But this does not appear to be what ACOE is intending to do for GP 98-08.

The ACOE may feel it need not do project-specific environmental impact reviews for oil and gas development activities falling under GP 98-08 because other federal agencies may conduct such reviews in the future. It is true that some kind of project-specific NEPA assessment may be done when oil and gas development activities require a permit (e.g., from the USFS or BLM) for use of federal lands. However, no such project-specific assessments would be done for activities conducted on non-federal lands. Furthermore, **the Corps is the agency with expertise on wetlands and water impacts**; agencies such as the USFS and BLM are simply unqualified to do project-level reviews which adequately consider the values and threats to these resources. And, those agencies only consider the significance of an impact; they do not attempt to determine whether impact would be "unacceptable" under the 404(b) criteria, nor do they prohibit activities when impacts would be very significant. Thus, if GP 98-08 eliminates ACOE's responsibilities to perform project-level environmental reviews, this would also eliminate an important kind of regulatory control.

(C) GP 98-08 would eliminate the regulatory control of requiring selection of the least damaging alternatives for each project.

The 404(b) regulations also make clear that:

"no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences."

40 CFR § 230.10(a). This is a powerful regulatory control mechanism, and it is essential to meet the intent of the CWA. But GP 98-08, as proposed, would eliminate this regulatory control and authorize discharge of dredged or fill material from a large number of activities even though for many (if not all) of those activities, there exist practicable alternatives posing less impact to the aquatic environment. In other words, as proposed GP 98-08 does not require adoption of the least damaging alternative. In fact, GP 98-08 does not even require developers to consider less damaging alternatives to their proposed plans.³ We believe this is contrary to the intent of the Clean Water Act and to the plain language of the 404(b) regulations.

³ On page 3 of the April 15, 1999 Public Notice, the Corps concedes that the CWA regulations prohibit discharges where less damaging and practicable alternatives exist. See the last sentence in the extended quote presented above. Unfortunately, regardless of ACOE's intent, the language in the preamble of a Public Notice carries no legal weight. And the actual language of proposed GP 98-08 does not include any provision to implement the "alternatives" provision.

We realize that, as proposed, GP 98-08 would require projects to be designed to "minimize impacts that cannot be avoided." Proposed permit condition #16. However, requiring that impacts be minimized from a given project design is not the same thing as prohibiting that project if a different project design exists which might avoid those impacts altogether. There is a subtle but important point. To cut costs, a developer may design the project in such a way that impacts cannot be avoided. For instance, in planning the route of a new gas pipeline, a shortest path design would probably be developed. Suppose this route unavoidably crosses five streams. Under GP 98-08, the developer would only need to find ways to minimize the impacts of disturbing the five waterbodies. But it might be possible to find a longer (and slightly more expensive) path which crosses only three streams; GP 98-08 does not require this alternative to be considered, much less selected, even though this option is practicable and poses less impacts. In other words, even when the impacts of a particular design are "minimized" they may still exceed the maximum impacts of a completely different design.

After reviewing public comment on GP 98-08 and conducting a full 404(b), if the ACOE still believes a general permit is appropriate for authorizing diverse oil and gas development activities, the permit should require developers to select the least damaging practicable alternative and then to minimize the unavoidable impacts of that alternative. In cases where project developers refuses to pursue the least damaging alternative, GP 98-08 should not apply, and the ACOE should also deny a project-specific 404(b) permit in accordance with the CWA regulations.

(D) GP 98-08 would eliminate the regulatory control of requiring project-specific actions to minimize adverse impacts.

In the context of a project-specific 404(b) evaluations, the ACOE is authorized to take actions to "minimize adverse effects." 40 CFR Part 230, Subpart H. This includes, but is not limited to:

the authority to require relocation of a proposed discharge site,

the authority to limit the quantity and content of the discharge,

the authority to restrict discharge to certain times, and

the authority to require the use of particular kinds of technology and equipment that would reduce impacts.

Ibid. Exercise of these authorities unquestionably helps achieve the goals of the Clean Water Act. However, under GP 98-08, the ACOE would no longer evaluate individual projects and exercise these authorities. Once again, we see that GP 98-08 eliminates essential regulatory controls.

The proposed GP 98-08 does contain a list of generic "Permit Conditions" which would set limits on certain activities. But these Conditions do not represent the full authority contained in Subpart H. Furthermore, the GP 98-08 Conditions are inconsistent with Subpart H. For example, 40 CFR 230.74 states that "Discharge technology should be adapted to the needs of each site." GP 98-08 does not require or ensure technology will be adapted on a site-by-site basis; it allows the same technology to be used at all project sites. In fact, GP 98-08 only requires "appropriate" erosion and siltation controls to be used. There is no discussion of what constitutes an "appropriate" control or what factors might render a potential control technology inappropriate for use.

(E) GP 98-08 would eliminate the opportunity for project-specific public hearings that might help to minimize adverse impacts.

When a 404(b) permit is being considered for a particular project, the ACOE is required to provide the opportunity for citizens to request a public hearing on the proposal. See 33 CFR § 325.2(a)(5). Such hearings are invaluable for alerting the ACOE to previously unknown concerns and possible environmental impacts. It can also inform ACOE of the existence of reasonable alternatives that might pose less environmental harm. And, the hearing helps the ACOE decide whether a particular project is in the public interest. In effect, the public hearing is an important type of regulatory control mechanism. It is comparable in utility to the 404(b) factual determination. However, under GP 98-08, the ACOE would no longer allow citizens to request public hearings on dredge and fill activities associated with particular projects authorized under the permit. This will result in the loss of an important regulatory control.

In the Public Notice on proposed GP 98-08, ACOE is offering citizens the opportunity to request a public hearing on GP 98-08 itself. Unfortunately, such a hearing is of no use to citizens at this time. Citizens have no way of knowing, at this time, what concerns they might have over a particular project that may be authorized under GP 98-08 years in the future, and may affect a very specific location. How, for example, can citizens tell the ACOE now that they believe a particular project may have unacceptable impacts on the visual quality of a stream or marsh? They can't. Therefore, if the ACOE still believes a General Permit is appropriate (after reviewing public comments on this proposal), that permit should include the following terms:

a provision requiring that public notice be given (e.g., in local newspapers) of each project proposed for authorization under that Permit;

a provision allowing citizens to submit written comments on that proposed project; and

a provision allowing citizens to request a public hearing on that proposal.

The permit should also declare that all projects which might otherwise fall under within the scope of the General Permit are not officially authorized under that permit until the public comment and hearing period is closed. If substantial objections are voiced to the project, the ACOE should declare that the project in question cannot be authorized under the General Permit and requires a project-specific 404(b) permit for authorization.

To sum it up, 33 CFR § 322.2(f)(2) declares that general permits can only be issued in cases where doing so would eliminate unnecessary duplication of regulatory control. GP 98-08 goes far beyond this authority and seeks to eliminate essential regulatory controls where no duplication of those controls exists. We sympathize with ACOE's predicament; there is a substantial amount of work involved in ensuring the intent of the CWA is met. It is natural to attempt to combine procedural duties, where possible, to reduce the burden. But GP 98-08 goes too far. It should be either abandoned completely or significantly restructured to ensure important regulatory controls -- including project-specific 404(b) evaluations and project-specific notice, comment and hearing opportunities -- are preserved.⁴

2. The proposed general permit is inappropriate because ACOE has not demonstrated that the cumulative effects of all activities that might be authorized under the permit would be insignificant.

Even if the ACOE believed GP 98-08 would not eliminate any essential regulatory controls -- and even if ACOE believed all of the activities subject to GP 98-08 would be "substantially similar" in scope and effect -- the general permit cannot be issued unless ACOE demonstrates "the environmental consequences of the action are individually and cumulatively minimal." 33 CFR § 322.2(f). This has not been done for GP 98-08, and we believe it cannot be done.

⁴ In the Public Notice on GP 98-08, the ACOE states that "The District Engineer retains discretionary authority to prohibit the use of GP 98-08 on a case-by-case basis and require the submittal of an individual permit if a particular activity would result in more than minimal impacts to the aquatic environment." This does not address the foregoing concerns because it is fully discretionary and unenforceable (in fact the language of GP 98-08 does not reserve this right). Furthermore, it is unlikely that the District Engineer would ever use this authority because -- without always requiring project-specific 404(b) evaluations and allowing for project-specific hearings -- it is doubtful that the Engineer would ever learn that a "particular activity would result in more than minimal impacts to the aquatic environment." Indeed, the proposed Statement of Compliance, the ACOE declares that "For activities located on federal lands or non-federal lands with federal minerals, advance notification of the Corps is not required for authorization under ... GP 98-08."

Most oil and gas development activities in Wyoming occur in arid basins, where the existence of scattered wetlands and clean water are limiting factors on the size and distributions of wildlife populations. These aquatic ecosystems are therefore vital to terrestrial species as well aquatic species. Thousands of new wells are planned for development in Wyoming in the next decade alone. This development will be accompanied by thousands of miles of new roads and pipelines. Clearly, these activities poses a cumulatively significant impact to wetlands and waters, even if the impact from any "single project" may appear to be insignificant. Thus, a general permit of the type proposed is inappropriate and is contrary to the CWA.

3. An EIS Should be prepared on the proposal.

Since GP 98-08 does constitute a major federal action, it triggers the requirements of the National Environmental Policy Act (NEPA). If the action may pose significant environmental impacts -- either direct, indirect, or cumulative -- a full Environmental Impact Statement (EIS) must be prepared. If the ACOE is not sure whether these impacts may be significant, the agency must, at the very least, prepare an Environmental Assessment (EA) to determine if an EIS is needed.⁵

As discussed in the preceding sections of these comments, the activities that would be authorized under GP 98-08 do pose very significant impacts to the environment. Therefore an EIS should be prepared to help the ACOE decide whether GP 98-08 should be issued. The EIS should disclose all of the possible impacts associated with the various activities that would be authorized under the proposed general permit. In the Public Notice on GP 98-08, the ACOE says it is only intending to consider the "probable" impacts of these actions. This is contrary to NEPA. Notably, 40 CFR § 1502.22(b)(4) requires the Corps to evaluate potentially catastrophic impacts even if their probability of occurrence is low, i.e., even if they are "improbable."

The "significance" criteria developed by the U.S. Council on Environmental Quality also dictate that GP 98-08 warrants preparation of an EIS for other reasons. Specifically, an EIS is needed when "unique characteristics" would impacted, including wetlands and ecologically critical areas. ACOE has already determined that wetlands and waters are vital resources and that impacts to these areas should be allowed only in extraordinary circumstances. 40 CFR § 1508.27(b)(3). An EIS is also needed because this proposed action is highly controversial, poses unknown risks, involves cumulatively significant impacts, and establishes a precedent for future actions that will impact wetlands and waters. See 40 CFR §§ 1508.27(b)(4), (b)(5), (b)(6), and (b)(7). Thus, we feel an EA would only show that an EIS is needed, and we ask the Corps to being preparing an EIS at this time.

⁵ The Corps may elect to prepare an EIS even if it is unsure about whether significant impacts may occur.

The EIS should analyze and disclose the following kinds of information:

The number and combined area of new drill pads that may be constructed under GP 98-08.

The number of new miles of roads that may be constructed under GP 98-08.

The number of new miles of pipeline may be constructed under GP 98-08.

The number and combined area of reservoirs that may be developed under GP 98-08.

The combined acres of wetlands that may be destroyed or adversely impacted under GP 98-08.

The net amount and nature of discharge that may occur from activities authorized under GP 98-08.

The likelihood and impacts associated with catastrophic spills, oil/gas well blowouts, pipeline ruptures, fires, chemical release (e.g., saline waters), etc.

Which areas would be subject to the most development, and what are the possible water, wetland, and soil conditions in those areas?

Possible impacts (including habitat impacts) to threatened and endangered species, proposed species, candidate species, species listed as "Sensitive" by the USFS or a "Special Status Species" by the BLM, species listed as a Priority I species by the Wyoming Game and Fish Department, and species listed as S1-S2 or G1-G2 by the Wyoming Natural Diversity Database.

Regarding the latter, we point out that GP 98-08 -- as written -- allows projects to adversely impact threatened and endangered species; the permit conditions only prohibit actions that would jeopardize the existence of a species. However, given the precarious state of these species, even relatively small impacts to them can be significant, even where a "jeopardy" situation never results. In other words, "significant" under NEPA is not the same thing as "jeopardy" under the ESA.

The EIS must also rigorously explore and objectively evaluate reasonable alternatives to the proposed action (GP 98-08 and attached terms). We ask that the following alternatives be presented in the EIS:

The alternative of not issuing a general permit but requiring a separate 404(b) evaluations and permits for individual projects or activities.

Alternative based on stronger mitigation measures (see 40 CFR § 1508.25(b)(3)) for a general permit, such as:

Activities are not authorized under this general permit unless the applicant demonstrates that no practicable alternative exists which would pose less damage to the aquatic ecosystem and ACOE concurs with this determination.

Activities are not authorized under this general permit unless the applicant uses best available controls of erosion and siltation.

Activities are not authorized under this general permit unless they involve less than 0.5 acres of cumulative permanent impacts to waters or wetlands and less than 2.0 acres of cumulative temporary impacts to waters or wetlands.

This general permit expires in five years, or after activities previously authorized under this permit would permanently impact 15 acres of wetlands and/or waters, which ever comes first.

Construction of a single pad, a single road, or a single pipeline is not authorized under this general permit if such activity would impact more than 0.1 acre of a wetland or waterbody.

Activities are not authorized under this general permit if they would alter more than 100 linear feet of an ephemeral stream; alterations to intermittent and perennial streams and waterbodies are not authorized under this permit.

Stockpiling of fill in wetlands or other waters (including ephemeral and intermittent streams) is not authorized under this General Permit.

No discharge of dredged or fill material is authorized in aquatic habitat occupied by a species federally listed as threatened or endangered or proposed for such listing.

No discharge of dredged or fill material is authorized in aquatic habitat occupied by a plant or animal species listed as S1 in the Wyoming Natural Diversity Database if such discharge may adversely impact the species or its habitat.

No discharge of dredged or fill material is authorized if it could cause extirpation of the local population of any plant or animal species.

No activity is authorized which may involve discharge of dredged or fill material (including non-point source discharges) into a Class 1 water or into a designated or proposed Wild and Scenic River.

No activity is authorized within 300 feet of the source in natural spring areas; at the discretion of the ACOE, the no-activity buffer size may be extended where it is believed to be necessary to protect hydrologic functioning or ecological functioning (e.g., for wildlife use) of the spring.

No activity is authorized which could disrupt hydrologic functioning (including recharge) of wetlands or waterbodies.

Wetlands and aquatic habitat destroyed or degraded by development activities must be mitigated by construction of comparable habitat in the local area at a 5:1 replacement ratio (5 acres created for each acre destroyed).

4. The issuance of the proposed general programmatic permit is contrary to the Endangered Species Act.

Nearly all threatened, endangered, and proposed species depend in some way on the waters of the United States for their continued existence. In Wyoming, species such as the Wyoming Toad, Boreal Toad, Colorado River Squawfish, Prebles Meadow Jumping Mouse, and Kendall Warm Springs Dace are specifically dependent upon wetlands and waterbodies. Because GP 98-08 would authorize activities which impact waters and wetlands in Wyoming, it can adversely impact federally listed species.

Section 7(a) of the Endangered Species Act requires all federal agencies to utilize their authorities to help conserve the ecosystems upon which endangered species and threatened species depend. In proposing GP 98-08, the ACOE has not met this obligation.

On the issue of threatened and endangered species, for instance, GP 98-08 would only prohibit activities which are "likely to jeopardize the continued existence of species, or critical habitats...." This is the lowest possible protection ACOE can offer listed species; it allows listed species to be killed as a result of discharge and wetland development, and it allows extirpation of local populations of listed species.

Thus, ACOE is not using its authorities to help conserve threatened and endangered species or the ecosystems upon which these species depend. This is contrary to the ESA.

There are many ways ACOE can utilize its authorities -- under the ESA and CWA -- to help conserve these species and their habitats. For example, assuming it is even appropriate to issue a General Permit of the type proposed here, ACOE should include a provision that stipulates the permit only applies to activities which would not pose any impacts to threatened, endangered, or proposed species or their habitats (including, but not limited to critical habitat). If a particular project may pose any such impact, the ACOE should declare that a project-specific 404(b) permit must be sought so the harms to the species can be weighed against the project benefits and so practicable alternatives can be explored.

The ACOE is also violating the ESA in a second way. Section 7 of the ESA requires the Corps to consult with the U.S. Fish and Wildlife Service (FWS) if a proposed federal action may impact threatened or endangered species or their critical habitat. Since the Permit Conditions would allow such impacts to occur, so long as they do not jeopardize the existence of a listed species, it is clear that GP 98-08 does pose impacts that trigger Section 7 consultation. In the public notice on GP 98-08, the ACOE states that ESA consultation will occur in the future for particular projects that may impact listed species or their habitats. However, this is insufficient to satisfy the Section 7 requirements of GP 98-08 itself; since GP 98-08 constitutes a broad federal action, it requires consultation with FWS. This is necessary to ensure the cumulative effects of the programmatic permit -- and other activities harming T&E species -- are evaluated together so an informed decision can be made on whether or not a jeopardy situation exists.

After reviewing public comments on this proposed action, if the ACOE still believes a general permit is appropriate for the activities in question, we ask ACOE to immediately enter into formal consultation with the FWS.

5. If a general permit is deemed appropriate, all of the activities authorized under the permit should be subject to in depth 404(b) evaluation.

The fundamental precept of the 404(b) regulations is that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern." 40 CFR § 230.1(c).

To make this determination, ACOE must apply the evaluation criteria set forth in 40 CFR Part 230 by the EPA. Only by applying these evaluation criteria will it be possible to determine whether the proposed permit would meet the Clean Water Act's purpose of "restor[ing] and maintain[ing] the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." 40 CFR § 230.1(a).

Unfortunately, the ACOE has not demonstrated that the activities that would be authorized by to GP 98-08 -- either individually or in combination with all other activities affecting Wyoming ecosystems -- pose acceptable levels of impacts.

As discussed in previous sections of these comments, different activities pose different degrees of impacts depending on the nature of the action and its location. Even if activities which are substantially similar in nature (e.g., size, scope, timing, and type of disturbance) can have very different effects. This is because Wyoming is a very large and geographically diverse state. Conditions vary on a large-scale (e.g., arid basis divided by mountainous forests) and small-scale (e.g., soil type variations, vegetative conditions, slope steepness and stability, riparian communities dividing upland and xeric communities, etc.). As a result, some oil and gas development activities may pose individually minor impacts, while other activities of the same kind pose unacceptable impacts.

Furthermore, it is already known that, collectively, oil and gas drilling in limited regions of Wyoming pose significant impacts to ecosystems. Indeed, BLM has issued a number of programmatic EIS's documenting some of these impacts for development of oil and gas fields. EIS's are only necessary when impacts are significant. However, neither BLM nor any other agency has done a state-wide impact assessment on these activities, so it remains undetermined whether on the state-wide level all of these collective activities are posing unacceptable impacts. ACOE must therefore perform a state-wide assessment, using the 404(b) criteria, to make this determination. If any unacceptable impacts may occur, GP 98-08 should not be issued. As discussed previously, we do not believe it will be possible for ACOE to perform such a state-wide 404(b) evaluation for all of the activities in question -- at least, not one which is scientifically and legally defensible. Again, we urge the ACOE to abandon the general permit proposal and revert to issuing project specific 404(b) permits.

6. If a general permit is deemed appropriate, the ACOE should condition the permit to require a "case-by-case reporting and acknowledgement system" to protect the public interest.

Under the CWA regulations, the ACOE may, when it would be in the public interest, condition a general permit to require a case-by-case reporting and acknowledgement system for activities authorized under the permit. 33 CFR § 325.5(c). Given the size and diversity of the Wyoming landscape -- and the wide variety of activities involved in oil and gas development -- the public interest surely warrants such a system for GP 98-08. This would give the public more information about specific project activities and their impacts. And this information would also help the District Engineer decide when particular projects may pose impacts that exceed the scope of GP 98-08.

In the Public Notice on proposed GP 98-08, the ACOE states that "The District Engineer retains discretionary authority to prohibit the use of GP 98-08 on a case-by-case basis and require the submittal of an individual permit if a particular activity would result in more than minimal impacts to the aquatic environment." However, this is not the same thing as requiring a case-by-case reporting and acknowledgement system. Furthermore, the proposed Notification Procedures for GP 98-08 (Appendix C to the proposed permit) are vague and do not apply to activities located on Federal lands. Other information which should be required to be reported for any development activities affecting wetlands and/or waterbodies include:

- A description of the types of less damaging alternatives explored and why they are not being pursued;
- A list of the types of plant and animal species known or suspected to inhabit the area and aquatic ecosystem affected by the proposed activities;
- A description of the type of equipment that will be used for construction, reclamation, and mitigation;
- A description of the anticipated timing and duration of the activities;
- A description of the vegetation types that might be disturbed by the proposed activities;
- A description of the soil types and conditions (e.g., hydric character, potential for erosion and rilling) that may be disturbed by the proposed activities;
- A description of the slope and slope stability conditions;
- A map showing locations of probable point source discharges as well as non-point-source discharges associated with the proposed activities;
- An analysis and description of the amount and composition of any materials that would be discharged, such as volume and salinity of discharged brine waters;
- A description of existing visual quality and possible visual impacts of the proposed disturbances;
- A description of special features in the vicinity (e.g., special aquatic sites, Wild and Scenic Rivers, Class 1 waters, historic landmarks, parks, scenic highways, Wilderness Study Areas, Areas of Critical Ecological Concern, etc.); and

An analysis of the potential for catastrophic impacts, such as major hydrocarbon spills or fires, even if the likelihood of occurrence is low.

The proposed Notification Procedures for GP 98-08 also require the project developer to only notify "adjacent property owners" of the planned development activities and allow those individuals to comment. We believe this is contrary to CWA and the equal protection provisions of the U.S. Constitution. Other citizens may have concerns not shared by "adjacent property owners" and these individuals should be given the same advanced notification and opportunity to submit comments. This can be accomplished by publishing an announcement of proposed activities in local and regional newspapers and asking for comments. Any general permit should require this kind of notification to protect the public interest.

7. Other objections to proposed GP 98-08.

We have several other concerns about GP 98-08 we would like ACOE to be aware of and address in future proposals of this type.

First, we do not believe it is possible to mitigate loss of naturally occurring wetlands and waters through construction of "artificial" wetlands. The proposed GP 98-08 apparently recognizes artificial wetlands are less valuable than natural ones, and would therefore require mitigation on a 2:1 replacement ratio (2 acres created for each acre destroyed). We object to this because naturally occurring wetlands and waters generally have far more than "2 times" the value of artificial wetlands. Furthermore, natural wetlands are the result of special conditions which sustain the wetlands over long periods of time. For artificial wetlands, there is no assurance they would provide wetland values over the long term (e.g., centuries or longer). Thus, we feel ACOE should try to achieve no loss of naturally occurring wetlands; if this is impossible, mitigation through construction of replacement wetlands should be required at a much higher ratio than 2:1 (10:1 may not even be sufficient).

Second, GP 98-08 does not require adequate monitoring of activities and impacts. Given the wide variety of activities that would be authorized under the permit (without project-specific review), and given the diversity of conditions across Wyoming, monitoring is essential to ensure unacceptable impacts do not occur. Instead of requiring ACOE to perform oversight and monitoring activities, GP 98-08 would apparently entrust developers with monitoring and reporting their own activities and impacts. If significant unexpected impacts occur, it is unlikely they would be reported out of a (justified) concern that ACOE would revoke the project's approval under GP 98-08 and require a project-specific 404 permit. Any general permit must ensure ACOE -- and not project developers -- monitors and enforces permit conditions.

Third, GP 98-08 seems to ignore impacts to wetlands and waterbodies associated with dewatering and water table draw-downs. Such activities can have very severe impacts on aquatic ecosystems -- in some cases eliminating the aquatic ecosystem altogether. Permits should not be issued for activities which could cause such impacts.

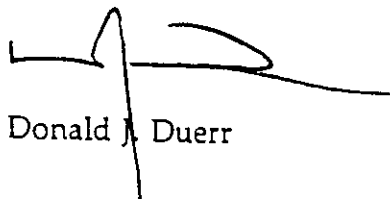
Fourth, GP 98-08 seems to ignore discharge of excessive water into wetlands and waterbodies. The focus seems to be on limiting sediment introduction. While creating new surface waters may seem to be a good, it can cause problems for aquatic ecosystems. For example, even if clean water is discharged into a stream channel (which would appear to involve no discharge of dredged or fill material), a large volume of water can erode soils and stream banks, and even irreparably alter the stream channel. Thus, even clean water can result in new discharges of sediment into waterbodies. On the other hand, some aquatic ecosystems are also naturally saline, so discharging fresh (low salinity) water into these systems could disrupt that aquatic ecosystem. GP 98-08 ignores this issue. Likewise, most aquatic ecosystems have a natural temperature regime and would be harmed if water having a different temperature were introduced. Again there would be no discharge of sediment, but the aquatic ecosystem could suffer. Any general permit should ensure such potential impacts are fully considered and avoided.

Another potentially serious problem ignored in GP 98-08 is the discharge of saline waters (brought to the surface from wells) into surface waters. While saline waters may not carry suspended sediments, they would alter the water chemistry; even small additions of salts into fresh water aquatic ecosystems can have devastating results. Any general permit should also prohibit such discharges.

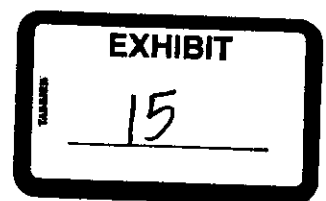
Conclusion

For all of the foregoing reasons, we ask the ACOE not to issue GP 98-08; we feel requiring individual project-specific 404 permits would better protect Wyoming's precious waters and aquatic ecosystems, and would better meet the intent of the Clean Water Act. If ACOE disagrees and still believes a general permit is appropriate, we ask that an EIS be prepared on the proposal.

Sincerely,



Donald J. Duerr





REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

July 6, 2000

Wyoming Regulatory Office
2232 Dell Range Blvd., Suite 210
Cheyenne, Wyoming 82009

Mr. Alan R. Pierson, Director
U.S. Bureau of Land Management
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

Dear Mr. Pierson:

Enclosed is a copy of General Permit (GP) 98-08 that our office developed specifically for authorization of oil and gas exploration and development activities in Wyoming pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344). Section 404 requires authorization from the U.S. Army Corps of Engineers for activities that include a discharge of dredged or fill material into waters of the United States. The term "waters of the United States" has been broadly defined by statute, regulation, and judicial interpretation to include all waters that were, are, or could be used in interstate commerce such as interstate lakes and rivers as well as intrastate lakes, rivers, streams (including ephemeral streams), mudflats, wetlands, sloughs, prairie potholes, playa lakes, and ponds. The Corps regulations were published in the November 13, 1986, edition of the Federal Register (Vol. 51, No. 219) at 33 CFR Parts 320 through 330.

Although GP 98-08 is applicable to activities on both public and private lands, the permit serves as a programmatic general permit as defined in Part 325.5(c)(3) of the Corps regulations which allows the Corps to issue permits that are founded on an existing regulatory program and designed to avoid duplication with that program. As you may recall, Mr. Thomas Johnson from our office discussed the concept of developing a programmatic general permit during a meeting with you on March 12, 1998.

In this case, GP 98-08 is programmatic because it allows the U.S. Bureau of Land Management (BLM) to make decisions regarding the applicability of the permit for oil and gas related activities that are within the BLM's jurisdiction. However, issuance of GP 98-08 does not obligate the BLM to verify use of the permit in instances where it may be applicable nor does it require any documentation from the BLM when its use is verified. It is simply a tool that the BLM can use to assist companies in obtaining Section 404 authorization by verifying that particular activities satisfy permit criteria based upon the BLM's environmental analysis. Under certain circumstances, the permittee is required to submit a Statement of Compliance to the Corps after completion of a project in order to document use of the permit for our records. As with all permits, the Corps is responsible for investigation of any reports of non-compliance with permit conditions and for enforcement actions if warranted.

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Our office will be distributing a public notice announcing issuance of GP 98-08 in the near future. Copies of the public notice will be sent to several oil and gas companies and all of the BLM's field offices. We are also in the process of arranging a brief conference with staff from the field offices to advise them of recent changes in the Corps regulatory program, including issuance of new Nationwide General Permits and GP 98-08.

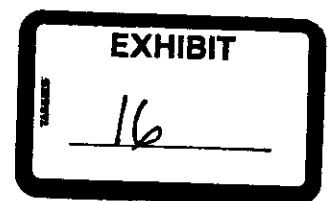
We believe that GP 98-08 will be a useful tool for streamlining the regulatory process for the oil and gas industry in Wyoming without increasing the BLM's workload. We appreciate your assistance in reaching that goal through successful implementation of the permit. If you have any questions about GP 98-08, please contact me or Mr. Johnson at (307) 772-2300.

Sincerely,



Matthew A. Bilodeau
Program Manager
Wyoming Regulatory Office

Enclosure



COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT

Committee on Mitigating Wetland Losses

Board on Environmental Studies and Toxicology

Water Science and Technology Board

Division on Earth and Life Studies

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C.

Preface

The U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA) share responsibility for regulating the mitigation (lessening of impacts) of damages to wetlands. In response to a request from EPA, the National Research Council (NRC) formed the Committee on Mitigating Wetland Losses to evaluate mitigation practice as a way to restore and maintain the quality of the nation's waters, particularly as regulated under Section 404 of the Clean Water Act.

The committee reviewed the available literature on replacement of wetland functions, considered both restoration and creation efforts, visited several mitigation sites around the United States, and then evaluated both the ecological performance of mitigation projects and the institutions under which mitigation projects are conducted (permittee-responsible mitigation banks and in-lieu fee programs). At a series of five meetings, the committee worked in a truly interdisciplinary and collaborative manner to develop the conclusions and recommendations presented in this report.

The committee is grateful for the briefings and the assistance provided by the staff of EPA, the Corps, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service.

The committee is also grateful for the excellent and untiring support provided by the NRC staff, who organized the meetings and field trips and kept us on track in addressing the major tasks, as well as the fine details in report preparation. Dr. Suzanne van Drunick, our outstanding project director, kept the process on track and made sure that the report

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PREFACE

was coherent. We all benefited greatly from the help of Jennifer Saunders, who followed Leah Probst as project assistant. Ruth Crossgrove, Mirsada Karalic-Loncarevic, and Barbara O'Hare helped with the many details that made the report ready for publication. Dr. David Policansky initiated the project, and we thank him for providing stimulating discussions. Dr. James Reisa's suggestions improved the Executive Summary.

The committee members were exemplary in their dedication to this complicated task; without their expertise, hard work, and timely responses, completion of the project would not have been possible.

Joy B. Zedler
Chair, Committee on Mitigating Wetland Losses

Executive Summary

Wetlands are complex ecosystems that, depending on their type and on circumstances within a watershed, can improve water quality, provide natural flood control, diminish droughts, recharge groundwater aquifers, and stabilize shorelines. They often support a wide variety of plants and animals, including rare and endangered species, migratory birds, and the young of commercially valuable fishes. Their beauty and diversity contribute recreational value.

The current high regard for wetlands, however, contrasts with earlier practices of draining and filling prior to the mid-1970s. Some past federal policies encouraged wetland conversion to promote agricultural, commercial, and residential development; mosquito control; and other activities that benefited society. By the 1980s the wetland area in the contiguous United States had decreased to approximately 53% of what it had been in the 1780s.

In recent years, concern about the loss of wetlands in the United States has led to federal efforts to protect wetlands on both public and private lands. Provisions in the Clean Water Act especially, the Food Security Act, several court rulings, and government policies, regulations, and directives regulate discharge of pollutants to wetlands and the filling of wetlands.

A principal objective of the Clean Water Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency define the "waters of the United States" to include

most wetlands. This interpretation recognizes that some wetlands improve water quality through nutrient cycling and sediment trapping and retention; it is based on the judgment that some goals of the Clean Water Act cannot be achieved if wetlands are not protected. Indeed, in 1989, President Bush stated that "no net loss" of wetlands was a goal of his administration, and that was reflected in interagency agreements soon afterward.

The Clean Water Act prohibits the discharge of materials, such as soil or sand, into waters of the United States, unless authorized by a permit issued under Section 404 of that act. The Corps of Engineers, or a state program approved by the Environmental Protection Agency, has authority to issue such permits and to decide whether to attach conditions to them. To achieve no net loss of wetlands within the Section 404 program, a permittee is first expected to avoid deliberate discharge of materials into wetlands and then to minimize discharge that cannot be avoided. When damages are unavoidable, the Corps of Engineers can require the permittee to provide "compensatory mitigation" as a condition of issuing a permit.

Compensatory mitigation specifically refers to restoration, creation, enhancement, and in exceptional cases, preservation of other wetlands as compensation for impacts to natural wetlands. The permit recipient, either on a permit-by-permit basis or within a single-user mitigation bank, carries out "permittee-responsible" mitigation. In third-party mitigation (i.e., commercial mitigation bank, in-lieu fee program, cash donation, or revolving fund program), another party accepts a payment from the permittee and assumes the permittee's mitigation obligation. Most compensatory mitigation has been done by permit recipients, rather than by third parties.

The Committee on Mitigating Wetland Losses, which prepared this report, was established by the National Research Council to evaluate how well and under what conditions compensatory mitigation required under Section 404 is contributing toward satisfying the overall objective of restoring and maintaining the quality of the nation's waters. The committee reviewed examples of wetland restoration and creation projects in Florida, Illinois, and southern California that were required as a condition of Section 404 permits; received briefings from outside experts; and conducted an extensive review of the scientific literature on wetlands, government data and reports, and information provided by a wide variety of experts and organizations.

THE COMMITTEE'S PRINCIPAL FINDINGS

Conclusion 1: The goal of no net loss of wetlands is not being met for wetland functions by the mitigation program, despite progress in the last 20 years.

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A recent study by the U.S. Fish and Wildlife Service suggests that the rate of loss of wetland area has slowed over the past decade. From 1986 to 1997, the estimated annual rate of wetland loss (58,545 acres per year) was about 23% that of the previous decade. Wetland losses due to agriculture declined precipitously, and there were significant reductions in losses due to urban and rural development. The decrease in wetland loss due to development may be attributable to the 404 permit process; however, the available data are not sufficient for drawing a firm conclusion.

The Corps of Engineers keeps data on the areas of permitted fill and areas of compensatory mitigation required as a condition for permits. From 1993 to 2000, approximately 24,000 acres of wetlands were permitted to be filled, and 42,000 acres were required as compensatory mitigation on an annual basis. Thus, 1.8 acres were supposed to be mitigated (i.e., gained) for every 1 acre permitted (i.e., lost). If the mitigation conditions specified in permits were actually being met, this ratio suggests that the 404 permit program could be described as resulting in a net gain in jurisdictional wetland area and function in the United States. The committee, however, found that the data available from the Corps were not adequate for determining the status of the required compensation wetlands. In addition, the data do not report the wetland functions that were lost due to the permitted fill. Further, the literature on compensatory mitigation suggests that required mitigation projects often are not undertaken or fail to meet permit conditions. Therefore, the committee is not convinced that the goal of no net loss for permitted wetlands is being met for wetland functions. The magnitude of the shortfall is not precisely known and cannot be determined from current data.

Recommendations

- The wetland area and functions lost and regained over time should be tracked in a national database. This database could include the Corps of Engineers' Regulatory Analysis and Management System database.
- The Corps of Engineers should expand and improve quality assurance measures for data entry in the Regulatory Analysis and Management System database.
- The Corps of Engineers, in cooperation with states, should encourage the establishment of watershed organizations responsible for tracking, monitoring, and managing wetlands in public ownership or under easement.

Conclusion 2: A watershed approach would improve permit decision making.

Wetland functions must be understood within a watershed framework in order to secure the purposes of the Clean Water Act. The federal

guidelines for permit decision making express a strong preference for compensation as near the permitted impact site as possible and for the same wetland type and functions. The committee concluded that such a preference for on-site and in-kind mitigation should not be automatic, but should follow from an analytically based assessment of the wetland needs in the watershed and the potential for the compensatory wetland to persist over time.

On-site compensation is typically constrained by hydrological conditions that are likely to have been or are being modified by the developments requiring mitigation. Hydrological conditions, including variability in water levels and water flow rates, are the primary driving force influencing wetland development, structure, functioning, and persistence. Proper placement within the landscape of compensatory wetlands to establish hydrological equivalence is necessary for wetland sustainability. The ability to achieve desired outcomes within a specific location is also a function of the degree of degradation of the hydrological conditions, soils, vegetation, and fauna at the site. The more degraded the local site and the more degraded the watershed, the less likely it will support a high-quality project. Thus, opportunities for in-kind compensation need to be sought within a larger landscape context.

Even with a suitable position in the landscape, the ability to establish desired wetland functions will depend on the particular function, the restoration or creation approach used, and the degree of degradation at the compensation site. Landscape position, hydrological variability, species richness, biological dynamics, and hydrological regime all are important factors that affect wetland restoration and mitigation of loss. Some wetland types—in particular, fens and bogs—cannot be effectively restored with present knowledge. Mitigation efforts that do not include a proper assessment of such factors are unlikely to contribute to the goals of the Clean Water Act.

Recommendations

- Avoidance is strongly recommended for wetlands that are difficult or impossible to restore, such as fens or bogs.
- Site selection for wetland conservation and mitigation should be conducted on a watershed scale in order to maintain wetland diversity, connectivity, and appropriate proportions of upland and wetland systems needed to enhance the long-term stability of the wetland and riparian systems. Regional watershed evaluation would greatly enhance the protection of wetlands and/or the creation of wetland corridors that mimic natural distributions of wetlands in the landscape.
- All mitigation wetlands should become self-sustaining. Proper

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placement in the landscape to establish hydrogeological equivalence is inherent to wetland sustainability.

- The biological dynamics should be evaluated in terms of the populations present in reference models for the region and the ecological requirements of those species.
- The science and technology of wetland restoration and creation need to be based on a broader range of studies involving sites that differ in degree of degradation, restoration efforts, and regional variations. Predictability and effectiveness of outcomes should then improve.
- Hydrological variability should be incorporated into wetland mitigation design and evaluation. Except for some open-water wetlands, static water levels are not normal. Because of climatic variability, it should be recognized that many wetland types do not satisfy jurisdictional criteria every year. Hydrological functionality should be based on comparisons to reference sites during the same time period.
- Riparian wetlands should receive special attention and protection, because their value for stream water quality and overall stream health cannot be duplicated in any other landscape position.

A mitigation site needs to have the ability to become self-sustaining. This means that the hydrological processes that define a wetland in the ecosystem need to be present and expected to persist in perpetuity. To aid regulators and mitigators in designing projects that will become ecologically self-sustaining, the committee offers 10 operational guidelines.

Operational Guidelines for Creating or Restoring Self-Sustaining Wetlands

1. Consider the hydrogeomorphic and ecological landscape and climate.
2. Adopt a dynamic landscape perspective.
3. Restore or develop naturally variable hydrological conditions.
4. Whenever possible, choose wetland restoration over creation.
5. Avoid over-engineered structures in the wetland's design.
6. Pay particular attention to appropriate planting elevation, depth, soil type, and seasonal timing.
7. Provide appropriately heterogeneous topography.
8. Pay attention to subsurface conditions, including soil and sediment geochemistry and physics, groundwater quantity and quality, and infaunal communities.
9. Consider complications associated with wetland creation or restoration in seriously degraded or disturbed sites.
10. Conduct early monitoring as part of adaptive management.

Conclusion 3: Performance expectations in Section 404 permits have often been unclear, and compliance has often not been assured nor attained.

The attainment of no net loss of wetlands through both permittee and third-party mitigation requires that performance requirements for individual compensation sites be clearly stated and that the stated requirements will be met by the parties responsible for the mitigation. Some mitigation sites studied by the committee have met the criteria for permit compliance and are, or show promise of, developing into functional wetlands. However, in many cases, even though permit conditions may have been satisfied, required compensation actions were poorly designed or carelessly implemented. In other cases, the location of the mitigation site within the watershed could not provide the necessary hydrological conditions and hence the desired plant and animal communities, including buffers and uplands, necessary to achieve the desired wetland functions.

At some sites, compliance criteria were being met, but the hydrological variability that is a defining feature of a wetland had not been established. Concern that sites might not meet hydrological criteria used to define wetlands in the permitting process often encouraged construction of permanently flooded open-water wetlands. In some situations, seasonally and intermittently flooded or saturated wetlands would have better served the needs of the watershed. Compliance criteria sometimes specified plant species that the site conditions could not support or required plantings that were unnecessary or inappropriate. Monitoring is seldom required for more than 5 years, and the description of ecosystem functions in many monitoring reports is superficial. Legal and financial mechanisms for assuring long-term protection of sites are often absent, especially for permittee-responsible mitigation.

Long-term management is especially important, because wetland restoration and creation sites seldom achieve functional equivalency with reference sites or comply with permit requirements within 5 years. Up to 20 years may be needed for some wetland restoration or creation sites to achieve functional goals. The amount of time needed to become fully functional depends on the type of wetland, its degree of degradation, conditions in the surrounding watershed, and uncertainties in the application of scientific understanding. Once wetlands become fully functional, long-term stewardship, including monitoring or periodic assessment, is critical to achieving the goals of the Clean Water Act. "Long-term stewardship" implies a time frame typically accorded to other publicly valued natural assets, such as parks. This time frame emphasizes the importance of developing mitigation wetlands that are self-sustaining, so that the long-term costs are not unmanageable. The committee recommends three general goals to ensure compliance of sites that contribute to the water-

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shed. The committee made nine specific recommendations to achieve these goals.

General Goals

- Individual compensatory mitigation sites should be designed and constructed to maximize the likelihood that they will make an ongoing ecological contribution to the watershed; this contribution should be specified in advance.
- Compensatory mitigation should be in place concurrent with, and preferably before, permitted activity.
- To ensure the replacement of lost wetland functions, there should be effective legal and financial assurances for long-term site sustainability and monitoring of all compensatory wetland projects.

Specific Recommendations

- Impact sites should be evaluated using the same functional assessment tools as used for the mitigation site.
- Mitigation projects should be planned with and measured by a broader set of wetland functions than are currently employed.
- Mitigation goals must be clear, and those goals carefully specified in terms of measurable performance standards, in order to improve mitigation effectiveness. Performance standards in permits should reflect mitigation goals and be written in such a way that ecological viability can be measured and the impacted functions replaced.
- Because a particular floristic assemblage might not provide all the functions lost, both restoration of community structure (e.g., plant cover and composition) and restoration of wetland functions should be considered in setting goals and assessing outcomes. Relationships between structure and function should be better known.
- The Corps of Engineers and other responsible regulatory authorities should use a functional assessment protocol that recognizes the watershed perspective to establish permittee compensation requirements.
- Dependence on subjective, best professional judgment in assessing wetland function should be replaced by science-based, rapid assessment procedures that incorporate at least the following characteristics: effectively assess goals of wetland mitigation projects; assess all recognized functions; incorporate effects of position in landscape; reliably indicate important wetland processes, or at least scientifically established structural surrogates of those processes; scale assessment results to results from reference sites; are sensitive to changes in performance over a dynamic range; are integrative over space and time; and generate parametric and dimensioned units, rather than nonparametric rank.

- The Corps of Engineers and other responsible regulatory authorities should take actions to improve the effectiveness of compliance monitoring before and after project construction.

- Compensatory mitigation sites should receive long-term stewardship, i.e., a time frame expected for other publicly valued assets, such as parks.

- The Corps of Engineers and other responsible regulatory authorities should establish and enforce clear compliance requirements for permittee-responsible compensation to assure that (1) projects are initiated no later than concurrent with permitted activity, (2) projects are implemented and constructed according to established design criteria and use an adaptive management approach specified in the permit, (3) the performance standards are specified in the permit and attained before permit compliance is achieved, and (4) the permittee provides a stewardship organization with an easement on, or title to, the compensatory wetland site and a cash contribution appropriate for the long-term monitoring, management and maintenance of the site.

Conclusion 4: Support for regulatory decision making is inadequate.

In addition to using a watershed framework, the federal regulatory authorities can work to improve functional wetland assessment, permit compliance monitoring, staff training, research, and collaboration with state agencies. The committee recommends that the Corps of Engineers, Environmental Protection Agency, and other responsible regulatory authorities take several specific actions.

Recommendations

- To assist permit writers and others in making compensatory mitigation decisions, a reference manual should be developed to help design projects that will be most likely to achieve permit requirements. The manual should be organized around the themes developed in this report. The Corps of Engineers should develop such a manual for each region, based in part on the careful enumeration of wetland functions in the 404(b)(1) guidelines and in part on local and national expertise regarding the difficulty of restoring different wetland types, hydrological conditions, and functions in alternative restoration or creation contexts.

- The Corps of Engineers and other responsible authorities should commit funds to allow staff participation in professional activities and in technical training programs that include the opportunity to share experiences across districts.

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- The Corps of Engineers and other responsible regulatory authorities should establish a research program to study mitigation sites to determine what practices achieve long-term performance for creation, enhancement, and restoration of wetlands.

- States, with the participation of appropriate federal agencies, are encouraged to prepare technical plans or initiate interagency consensus processes for setting wetland protection, acquisition, restoration, enhancement, and creation project priorities on an ecoregional (watershed) basis.

Conclusion 5: Third-party compensation approaches (mitigation banks, in-lieu fee programs) offer some advantages over permittee-responsible mitigation.

The committee evaluated several compensatory mitigation mechanisms and developed a taxonomy to evaluate their potential strengths and weaknesses. Mechanisms were characterized by the following five attributes: (1) on-site or off-site compensatory mitigation action; (2) responsible party; (3) timing of the mitigation actions; (4) whether the Mitigation Banking Review Team process is used; and (5) stewardship requirements. The committee does not favor any particular mechanism but has offered recommendations that will, if adopted, assure that permittee-responsible as well as third-party mitigation will secure no net loss of wetlands. In addition, the committee believes that no net loss of wetlands will require a strengthened partnership with the states.

Recommendations

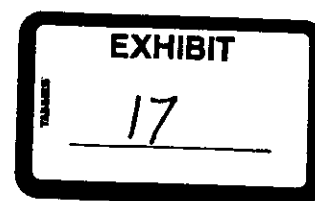
- The taxonomy developed by the committee is recommended as a reference point for discussions about compensatory mitigation. In practice, however, a compensatory mitigation mechanism may not fit neatly into one of the listed categories (e.g., mitigation bank versus in-lieu fee versus cash donation). Accordingly, the committee recommends that when an agency reviews mitigation options, it is most important to focus on their characteristics or attributes (e.g., who is legally responsible, the timing of the mitigation actions, whether the Mitigation Banking Review Team process is used, and whether stewardship requirements are in place).

- Institutional systems should be modified to provide third-party compensatory mitigation with all of the following attributes: timely and assured compensation for all permitted activities; watershed integration; and assurances of long-term sustainability and stewardship for restored, created, enhanced, or preserved wetlands.

- The Corps of Engineers and the Environmental Protection Agency should work with the states to expand their permitting and watershed planning programs to fill gaps in the federal wetland program.

CONCLUSION

The Clean Water Act Section 404 program should be improved to achieve the goal of no net loss of wetlands for both area and functions. The above recommendations will help to achieve this goal. It is of paramount importance that the regulatory agencies consider each permitting decision over broader geographic areas and longer time periods, i.e., by modifying the boundaries of permit decision making in time and space.



Restoration of Aquatic Ecosystems

Science, Technology, and Public Policy

Committee on Restoration of Aquatic Ecosystems:
Science, Technology, and Public Policy
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6

Wetlands

OVERVIEW

Wetlands occupy a special position in restoration ecology, because they have been affected by so many disturbances and because they fall under regulations that require mitigation of future damages. Unlike lakes and streams, wetlands have not always had recognized value. In recent years, public attitudes have changed from a general disregard of wetlands to a widespread desire to protect and restore them. A major policy forum has recommended "no-net-overall loss" and "net gain" in the quality and quantity of the nation's wetland resources (The Conservation Foundation, 1988). Thus, there have been numerous attempts to restore degraded wetlands, and there are many opinions about the status of wetland restoration.

The Bush administration has espoused the concept of no-net loss of wetland acreage and functioning. However, attempts to implement such a policy have proved difficult, because wetlands often stand in the way of development. Alaska wetlands were given special status (exemption) in the agreement to mitigate damages to wetlands (memo of agreement between EPA and COE, 1990). At present the area of protected wetlands may be reduced by modifying the delineation manual that is used to identify wetlands that are under the Clean Water Act of 1977 (P.L. 95-217), Section 404 jurisdiction. For example, seasonal wetlands would need to be wetter longer; peripheral areas would need to have vegetation classified as wetland

CONSTRAINTS ON ACHIEVING RESTORATION GOALS

The restoration of wetlands has the same general goal as that for all aquatic ecosystems: *returning the system to a close approximation of the predisturbance ecosystem that is persistent and self-sustaining* (although dynamic in its composition and functioning). The more degraded a site, the harder restoration becomes. A degraded wetland, surrounded by an industrial metropolis, may achieve its highest restoration state as an impaired system that requires active management to support native species. Even the smallest urban remnants, however, can serve an educational role, informing residents of their landscape heritage.

The sections below discuss several constraints on achieving 100 percent success in returning wetland ecosystems to their ideal predisturbance conditions. The most important of these appears to be the degree of disturbance to the site and its landscape, as illustrated by restoration projects visited by the committee or reviewed by others. Additional limiting factors include ecological, biological, and institutional constraints.

Degree of Disturbance to the Site and Its Landscape

In large urban settings (see Box 6.2), the entire hydrologic regime has been altered due to fills, drainage, ground water extractions, dams, dikes, levees, and other alterations. Water quality is often degraded by both point and nonpoint source pollutants. Sediment yields from the watershed are often great. Ecotones and buffers are often absent or degraded. Exotic plant and animal species are common.

Wetlands in rural contexts may be similarly affected. However, the number of impacts is often much lower for rural wetlands, where (because there is less development) there is often greater opportunity for restoring natural hydrology and functions. It may not be necessary to start with a comprehensive watershed and/or land use plan.

A simple model (Figure 6.3) shows the contrast between the restoration potential of a somewhat disturbed community (little damage, of short duration) that exists in a landscape with many other wetlands in good ecological condition and the restoration potential of a much-disturbed wetland in a highly disturbed (e.g., urban) landscape.

RELATIVELY UNDISTURBED SITE

The Kissimmee River site (see case study, Appendix A) is a *relatively* little-disturbed site in a landscape that retains many wetlands of a similar type. The flow of the river was diverted 20 years ago,

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restoration and that any functions retained by the degraded wetland will not be lost. Otherwise, the requirements of no net loss will be violated. Careful and detailed assessment of functions before and after restoration will be needed to justify restoration as mitigation for additional wetland loss.

Problems Encountered In Restoration Projects

A recent EPA publication (Kusler and Kentula, 1989) on the status of wetland creation and restoration efforts includes a wide range of experiences, opinions, case descriptions, and data that are useful to the committee's evaluation of restoration science efforts. Sixteen chapters, contributed by authors from around the nation, review the state of the art of restoring wetlands along the eastern, southern, and western coasts of the United States; in marsh, pothole, and wooded wetlands of the interior; and in riparian systems along the streams of the Midwest, West, and Southwest.

In reviewing wetland restoration projects in the coastal plain of Florida, Lewis (1989) listed several problems encountered during the early years following restoration of salt marshes, mangrove forests, salt barrens, and brackish marshes. These problems included incorrect elevations for target plant species, improper drainage (ponding and transplant mortality), wave damage, inappropriate transplanting material, human disturbance, and insufficient monitoring and reporting. He also indicated the need for buffers, control of exotic species, and long-term management of restored sites. Because mangrove ecosystems are dominated by trees, it is clear that it will take many years to restore their forest character. Attempts to plant older (>1 year) seedlings were considered risky due to lower rates of survival and higher cost.

Broome's (1989) review of tidal wetland restoration in the southeastern United States echoed many of Lewis's concerns, covering in addition experiences with sites that were too saline (hypersalinity restricts plant growth); or had the wrong soil physical properties (wrong texture) or soil chemistry (low nutrients); that had improperly timed construction (too late for planting); that lacked maintenance (e.g., replanting, fertilization, wrack removal); and that had potential problems (loss of genetic integrity) if transplanted materials were not obtained from areas close by.

For restoration projects carried out in the northeastern United States, Shisler (1989) identified additional problems associated with the colder climate. He noted that ice rafting can damage marsh vegetation, that thick peaty soils cannot be restored easily (sand is a

poor replacement), and that migrating Canada geese and snow geese can damage wetlands. He called attention to invasive species (*Phragmites australis*, *Lithrum salicaria*) and native *Typha* species that may need to be controlled to facilitate restoration of postpioneer plant communities. He also noted that in restoration projects, "endangered species" needs might not be met, because so few of their requirements are known.

Reviews of seagrass ecosystems (Fonseca et al., 1988; Fonseca, 1989) added three important problems to the growing list of challenges encountered in restoration projects: the difficulty of replacing climax species (e.g., turtlegrass, *Thalassia testudinum*; Williams, 1990), the inability of some restored sites to attract animal communities equivalent in abundance and composition to the communities of predisturbance sites, and the possibility of major transplant failure (200 acres in Biscayne Bay). On the Pacific Coast, eelgrass restoration is in a similar state, with little assurance that this wetland type can be replaced, due to poor quality of the overlying water and the underlying substrates, especially in urban areas (S. Williams, San Diego State University, personal communication, June 1990). Fonseca (1989) concludes that every eelgrass mitigation project results in a reduction in habitat. Problems that may be unique to this intertidal and subtidal habitat include damage from smothering by macroalgae, grazing by fish, clouding of water by decapods, and disturbance by motorboat propellers.

Attempts to restore forested wetlands of the Southeast (e.g., bottomland hardwoods and cypress swamps) have encountered difficulties related to the time required to replace mature trees, the lack of material to transplant, the lack of knowledge of how and when to carry out seeding or transplantation (Clewett and Lea, 1989), and altered hydrology (drainage for conversion to agriculture) of the wetland area. Natural forested wetlands may support hundreds of plant species, many of which thrive in the understory (91 percent of 409 species in one riverine forest were understory species). Old-growth forests are dominated by trees that gradually achieve a dominant role in the canopy and that are self-sustaining through their ability to reproduce in their own shade. It is not clear that such climax species can be successfully established in open sites, or whether their introduction must await development of seral (intermediate successional stage) plant communities. Clewett and Lea (1989) noted the need for intensive site preparation to reduce competition between weeds and transplanted tree seedlings. Their review was the first to mention insect herbivory and fire as potential problems. In many cases, restoration of suitable hydrologic conditions will be necessary. The short

time period within which forest restoration attempts have been monitored precludes an evaluation of their functional equivalency with natural reference systems.

In the arid and semiarid Southwest, restoration of riparian habitat has the unique problem that transplants need to be irrigated (Carothers et al., 1989). Because riparian forests became established during times of flooding, the hydrology necessary to recreate them cannot be produced at will. In many cases, dams prevent the restoration of the hydrology necessary to sustain riparian woodlands. Thus, although the tree canopy can be recreated through transplantation and irrigation, the system cannot maintain itself unless flooding regimes are also restored. In addition, invasion of exotics such as salt cedar (Tamarisk), damage to plants from grazing practices and from beaver, and permanent lowering of water tables due to ground water depletion by wells used for irrigation are other obstacles to the restoration of western riparian sites.

Hollands's (1989) discussion of pothole wetlands included problems that may be most frequent in wetlands that lack an outflow. These systems have highly variable water levels, and plant distributions can shift up or down the slopes within a year as establishment and mortality occur. In transplanting such sites, it may be difficult to predict the elevation that will have the appropriate hydrology in the following growing season. A swamp restoration project in Massachusetts experienced 80 percent mortality of planted shrubs due to a year of unusual flooding.

Wetlands along the fringes of lakes and rivers experience similar water-level fluctuations, as well as erosion due to wave action. Levine and Willard (1989) documented an Ohio case of dike undermining during a year of high water and transplant failure due to drought. Either water-level extreme can restrict restoration success.

Additional problems were noted for a highly urbanized wetland in San Diego Bay, where a combined freeway widening, new freeway interchange, and flood control project has been under way for six years. Such large, complicated projects are likely to experience problems with contaminated substrates and construction errors (see Box 6.6). The most recent error (July 1990) was the accidental drainage of an important lagoon used by birds.

Summary

The problems encountered during restoration include every aspect of construction—site selection, topographic contouring, transplantation, inadequate nutrient supplies for plant growth, and pest inva-

BOX 6.6 **UNFORESEEN PROBLEMS**

The problems encountered while restoring salt marsh habitat at San Diego Bay (see Box 6.1) were numerous. They indicate the need for constant surveillance during project construction as well as a mechanism to repair damage and errors as they develop. Problems will occur, and project managers will need to be on call to solve and correct them.

Toxic Materials

During the excavation of Connector Marsh, bulldozers unearthed an old landfill that contained toxic materials (discarded lead paint). The sediment was sufficiently contaminated with lead that large quantities had to be trucked to a toxic waste dump at a large and unanticipated cost.

Preproject Vegetation Salvage

An attempt was made to preserve the gene pool of cordgrass plants to be covered by the highway detour road. A 10,000 square foot intertidal nursery was excavated to receive the salvaged cordgrass. During excavation of the nursery site, just south of the Connector Marsh, an old city dump was uncovered, and the substrate was full of broken glass—an unforeseen hazard for personnel who did the transplantation work. Then, the initial transplant failed, apparently due to insect herbivory (transplants carried the larvae and pupae of the Dipteran, *Incirtella* sp., to the nursery). A second transplantation effort worked well, and the nursery plants thrived for about 5 years (1985-1990). Then, during a second restoration phase, bulldozers excavating channels adjacent to the nursery also bulldozed the nursery. The nursery had not been mapped as an ecologically sensitive area, and biologists were not on-site the day it happened.

Removal of Temporary Fill

In constructing the temporary detour road, contractors laid down a fabric layer so that the integrity of marsh soils could be preserved. Five years later, when the material was to be removed, some sections had buckled and sunk below the planned excavation grade. While the construction crew was on hold,

BOX 6.5 (continued)

biologists had little time to decide whether the buried fabric could be left or the excavation plans altered. Plans were immediately revised, so that all fabric could be excavated, and habitat intended for mid-upper marsh was replaced by lower marsh and tidal pond habitats.

Tidal Modifications

Excavation of two marshes caused major and sudden changes in the tidal flushing regime of the reference wetland at Paradise Creek. Early during construction, a tide gate was erroneously installed midway along the Connector Marsh channel. The gate was in place for more than a year, and it muted tidal flows to the northern four marsh islands and the Paradise Creek Marsh. Its removal, following the advice of researchers, led to increased growth of cordgrass in the northern four islands during 1988.

Early in 1990, three culverts were placed in the same channel, and a temporary access road was built with fill, in order to excavate an adjacent 17-acre marsh, known as Marisma de Nación. Tidal flows to Paradise Creek and the north islands were again muted. A hydrologist (Haltiner, 1990) advised that six culverts would be needed to provide adequate tidal flushing to the marshes upstream. Contractors suggested a cheaper alternative, the partial excavation of a planned flood control channel to San Diego Bay. This alternative was accepted, and the Connector Marsh restoration site was then subdivided hydrologically, with the northern half connected directly to San Diego Bay (providing strong tidal circulation) and the southern half connected through Sweetwater River. The access road was in place for several months until Marisma de Nación was completed. Removal of the access road led to a third major change in tidal flushing, with connection of the southern islands to the bay as well as to Sweetwater Marsh. Most recently, in November 1990, the direct tidal flows to San Diego Bay were terminated because the flood control channel was again under construction.

None of the physical impacts of these tidal modifications has been assessed. Hydrologists predicted that the new tidal regime would alter the sedimentation dynamics and, as a result, gradually modify the topography of the channels and marsh habitats (Haltiner, 1990). Both the constructed marsh and the natural reference wetland were affected by muted

BOX 6.6 (continued)

tidal flows and sudden shifts in tidal regimes. In late 1990, after the cordgrass marsh had experienced greater tidal flushing for about one growing season, the above-ground biomass of plants had increased significantly in both the natural and the constructed marsh sites (J. Zedler and R. Langis, San Diego State University, unpublished data). This finding supports the argument that impaired tidal flushing has been detrimental throughout the multiyear construction process. The lesson is that large-scale, long-term restoration projects will not provide "stable" hydrology until well after construction has been completed.

sion. The result is that many projects fall short of the goal of returning ecosystems to the predisturbance condition, and there is indeed considerable controversy over whether or not wetlands can actually be restored. The arguments are particularly important when wetland restoration is undertaken within the mitigation context, and the *promise* of full restoration of a degraded site *allows* a natural wetland to be destroyed.

Experience with wetland restoration varies with region and wetland type. Many coastal and estuarine mitigation projects have been constructed along the Atlantic Coast and have been monitored and evaluated in the scientific literature. Fewer projects have been followed along the Gulf of Mexico and Pacific coasts, and there is less information in the literature about the success of restoration in these regions. Less is known about how to restore inland as opposed to coastal wetlands. The most common types of freshwater wetland restoration projects are impoundments to create waterfowl and wildlife habitat and the establishment of marshes on dredged spoils along major rivers. Although there is much literature describing waterfowl abundances, there are few critical studies of the success of these restoration efforts as persistent, naturally functioning ecosystems. The problems encountered encompass every aspect of wetland restoration. If all were to coincide, the resulting worst-case scenario (see Box 6.7) would clearly be a total failure.

Worst-case restoration projects have happened, but the lack of reports makes documentation difficult, and describing the failures of projects that powerful entities consider successful is not without risk. Even with evaluation and reports of projects, there are often large differences in opinion about how well efforts succeeded.

BOX 6.7
CHARACTERISTICS OF A WORST-CASE
WETLAND RESTORATION PROJECT

Most restoration projects include at least one major shortcoming, and the worst cases have all the following attributes:

- No specific goal—Vague generalities, such as “optimize ecosystem integrity,” may take the place of testable objectives. If objectives are listed, they describe the proposed structure, not the functioning, of the site.
- The proposed restoration of one area justifies destruction of another (project is part of a mitigation agreement). In many cases, the destruction proceeds, but the restoration project never occurs (M. Kentula, U.S. Environmental Protection Agency, personal communication, June 1990). Mitigation may be out-of-kind and off-site, making it difficult to provide the lost functions. Net losses in both acreage and function result.
- Innumerable problems are encountered during the restoration process, making it impossible to follow plans; decisions are made on-site and without consultation. Biologists are not required to be present at critical times. Construction crews make errors that are uncorrectable.
- There is no follow-up to determine if the project was carried to completion or whether it achieved the restoration goals (or complied with mitigation requirements).
- Access is denied when an agency seeks permission to evaluate a restoration project on private land.
- There are no reports that can be reviewed by either agencies or scientists.
- The regulatory agency lacks the manpower to enforce requirements.
- Photographs of vegetation growing at the site are presented at local or national meetings proclaiming the project a success, without measurable criteria or data to support these claims.

CONTROVERSIES ABOUT THE SUCCESS OF
RESTORATION PROJECTS

Whether we can succeed in restoring wetlands is a controversial subject. The authors of the EPA review papers (Kusler and Kentula, 1989) were asked to evaluate the projects they described. Owing to a lack of standard criteria for measuring success and inadequate state-

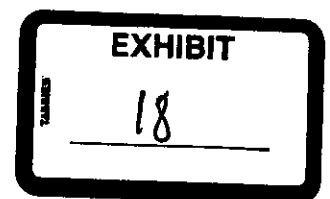
ments as to the goals of restoration, the degree of success achieved by many projects could not be characterized. The range of opinions on those that were judged covered the spectrum from success to total failure. At conferences dealing with restoration, creation, and mitigation, a similar range of opinions can be heard, at times with controversy over a single project that has been evaluated by different individuals (J. Zedler, personal observation). Many ecologists believe that it is a major challenge to recreate in a short period of time what nature has produced over centuries (Bradshaw, 1988).

Vested Interests

Some individuals insist that wetlands can be restored to fully functional ecosystems. They point to greenbelts, parks, and mitigation sites and to lovely pictures of wetland vegetation. Because so much wetland restoration is done within the regulatory context (i.e., as a mitigation requirement for damage done elsewhere), the stakes are incredibly high, and the controversy is a heated one, as indicated in the following example.

A San Diego developer hoped to convince resource agencies that he could build 416 multifamily units on 10 acres of a 20-acre urban wetland (Famosa Slough) without having a negative impact, even though he would need to fill intertidal flats and marsh habitats. He promised to restore an equal area of city-owned wetland and to increase the value of the remaining lagoon. Wetland biologists rebutted his claims, and the city decided to buy the property as a wildlife reserve. The developer then asked \$15 million for the site, claiming that the project could obtain a Section 404 permit from COE. Although there were many legal and political factors, the issue of whether or not lost wetland functions could be replaced played a role in determining the property value. In September 1990, after years of controversy and negotiation, the city of San Diego purchased Famosa Slough for \$3.5 million. The difference in sale price more than \$0.5 million per acre—is some measure of the value of being able to replace lost wetlands through compensatory restoration.

Within the mitigation context, proponents of new developments are extremely eager to believe that habitat functions can be moved about at will. It is not surprising that entrepreneurs promise the desired success and that considerable effort is made to promote completed projects as successful. At the same time, there is little incentive, in the form of funding, to evaluate projects independently, thoroughly, or scientifically. In particular, the funding needed to examine how mitigation sites *function* (not just what they look like) is nearly



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FIXING COMPENSATORY MITIGATION: WHAT WILL IT TAKE?^{1,2}

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Abstract. This study was undertaken to review the current status of permit-linked mitigation policies and practices in order to determine implications of the continued use of mitigation as a wetlands management tool within the United States. Based on reviews of both published literature and agency reports, our survey of past mitigation projects nationwide indicates that the success rate of permit-linked mitigation projects remains low overall. In addition, there is continuing difficulty in translating mitigation concepts into legal principles, regulatory standards, and permit conditions that are scientifically defensible and sound. Based on the record of past poor performance, we assert that continued piecemeal revision efforts focused on technical or scientific details are not likely to make compensatory mitigation more effective. There is need to acknowledge the extent to which non-scientific, real-world complications plague current policies and practices. To prevent continued loss of wetlands under compensatory mitigation, decisive action must be taken by placing emphasis on improving compliance, generating desired acreages, and maintaining a true baseline. Without selective changes in the status quo, current policies and poor implementation are likely to lead to further wetland losses.

Key words: compensatory mitigation; habitat mitigation; habitat replacement; man-made wetlands; mitigation failures; mitigation policies; permit compliance; restoration of aquatic ecosystems; wetlands management; wetlands mitigation; wetlands restoration.

It's deja vu all over again.
(attributed to Yogi Berra)

INTRODUCTION

In the space of two decades, mitigation has evolved from a seldom-used dictionary term to a heavily applied wetlands management practice that has become firmly entrenched with agency managers who are charged with the dual responsibilities of safeguarding the nation's wetlands and approving proposals for development. Questions about the advisability and success of mitigation projects surfaced over a decade ago (Race and Christie 1982), and persist in lively debates that continue to the present, bolstered by expanded scientific research and increased practical experience (e.g., Race 1985, Harvey and Josselyn 1986, Race 1986, Batha and Pendleton 1987, Zedler 1987, O'Donnell 1988, Redmond 1992). At the heart of the current debate is the practice of permit-linked compensatory mitigation: required actions that are intended to compensate for environmental damage or loss of habitat through replacement of functions, values, or acreage of wetlands proposed for destruction. Very often compensatory mitigation involves creation of new wetlands or enhancement of existing wetlands.

According to current federal policy, explicit trades

between permitted impacts and mitigation requirements should not be allowed, and mitigation efforts should be "sequenced," with a preference for avoiding and minimizing wetland impacts before resorting to compensatory mitigation. However, with so much at stake in the permit process, the unfortunate reality is that discussions often focus heavily on compensatory mitigation as a means of offsetting habitat damage or loss. Although hardly responsible for the majority of national wetland losses, the practice of compensatory mitigation remains a serious concern because it is a bartering scheme that trades permission to damage a known quantity of wetland area for the promise of some kind of replacement, sometimes at locations away from the impacted area. The manner in which this bartering is pursued varies widely under local, state, and federal agencies whose jurisdictions overlap in wetlands. Thus, the process of planning and permitting compensatory mitigation projects is not at all consistent.

In this paper we take a renewed look at mitigation in a broad context and ask once again whether mitigation—as currently conceived in policy and applied in practice—is a useful wetlands management tool or, rather, an option that inevitably contributes to further incremental loss of habitats regionally and nationally in response to persistent demands for development permits.

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¹ Manuscript received 14 July 1994; revised 3 March 1995; accepted 8 March 1995.

² For reprints of this group of papers on wetland mitigation, see footnote 2, page 33.

BACKGROUND

In reviewing the literature, it became clear we can find little that has not already been said in the mitigation debate. Every year, there are conferences in the United States with mitigation or restoration as a theme (e.g., Annual Symposium on the Restoration and Creation of Wetlands, Hillsborough Community College, Tampa, Florida). Moreover, several texts have addressed the full spectrum of mitigation issues (Kusler and Kentula 1990, NRC 1992, Thayer 1992). Each volume provides summaries of definitions, analyses of scientific advances, and discussion of protocols and guidelines for a variety of wetland mitigation, restoration, and creation options. It is clear that the field has progressed considerably since a time when there "was no consistent definition of what [mitigation] was nor any consensus as to how it should be applied" (Race and Christensen 1982).

While the proliferation of studies about mitigation is both encouraging and helpful, it is interesting to note that much of the work on mitigation remains outside the peer-reviewed literature. A computer search using BIOSIS revealed only 44 citations since 1987 for mitigation when the word was combined with the terms habitat, or wetland, or ecosystem. In addition, many of these entries were abstracts. In our opinion, this lack of peer review represents a serious flaw in the evolution of mitigation technology and philosophy.

If there is so much scientific and practical information about mitigation, why is there a lingering uncertainty of doubt about compensatory mitigation (Roberts 1993)? Part of the reason may come from its continuing close association with, and reliance on, restoration ecology. The National Academy of Sciences report on aquatic ecosystem restoration (NRC 1992) emphasizes the tremendous potential of restoration techniques for replicating lost functions and values as well as former plant and animal communities. In fact, the report advocates a goal of "restoring 10 million wetland acres" (4.05×10^6 ha) over the next 18 yr throughout the nation. However, as noted by Nicholas (1992):

one of the report's major contributions is an honest picture of the present state of wetland restoration—rudimentary, at best; criminally inept, at worst. The lack of knowledge about wetland functions and values and the lack of a larger planning context in which restorations are carried out are identified as serious limitations in ongoing efforts.

According to the NRC (1992) report, mitigation efforts cannot yet claim to have duplicated lost wetland functional values; nor has it been shown that restored wetlands maintain regional biodiversity or recreate functional ecosystems.

Further doubts about compensatory mitigation are raised from reviewing the outcome of actual mitigation

projects in the field. Despite evolving sophistication by the research and management community, the results are not encouraging, and the success of mitigation remains in serious doubt.

SURVEYS OF MITIGATION PROJECTS

Race (1985) contended that premature extrapolation of experimental results led to institutionalization of mitigation as a policy with little to suggest that it fulfilled expectations of restored ecosystem function. She based this conclusion on a review of 6 yr of permit history and surveys of 33 restoration projects located in San Francisco Bay. In general, noncompliance with permit conditions was the norm. Unfortunately, these findings were not unique.

Eliot (1985) reviewed 58 mitigation projects in San Francisco Bay that had been permitted over a 6-yr period. She found they did not adhere to established mitigation policies, they were frequently unsuccessful, and almost half of the projects had not been accomplished by the specified permit completion date. She advocated effective enforcement as the key to mitigation project completion, noting that its absence accounted for much of the noncompliance among permits in her study. She also noted that mitigation ratios (ratio of habitat replaced to habitat lost) varied widely among projects and were not consistently used to determine the acreage of compensating projects. This kind of arbitrariness all but guarantees opposition and legal challenges from developers, who generally feel that current wetlands policies are unfair and inequitable anyway (Wilmar 1986, Wilms 1990).

Quammen (1986a) reviewed studies of mitigation projects in various parts of the country, including Virginia, New England, New Jersey, Florida, and San Francisco Bay. She concluded that on the whole:

compliance with permit conditions is low and that effectiveness of restoration to compensate for wetland losses cannot yet be determined. Only when the project objectives and design criteria are clearly stated as part of the permit conditions, and monitoring is conducted and reported, will we be able to evaluate whether created wetlands are able to compensate for the losses in natural wetlands.

A New Jersey field survey and qualitative evaluation of 30 artificial salt-marsh projects (wetland permit and violation cases) revealed an array of problems including wave damage, sedimentation problems, deteriorating bulkheads, and unplanned shifts in species composition (Shisler and Charette 1986). Additional detailed quantitative sampling at eight of the sites indicated significant differences in nearly all sediment characteristics, vegetational parameters, and macroinvertebrate measures when compared to adjacent natural marshes. The authors concluded that the "restoration and creation of artificial marshes is in an early state of development . . . and their long-term success under var-

ious environmental conditions still needs to be experimentally tested."

R. A. Cobb³ conducted surveys of a wide variety of wetland mitigation sites in Texas and concluded that permitted activities led to a 0.6:1 ratio of habitat replacement to loss. He concluded that conflicting goals among agencies, lack of customized plans, lack of performance bonds, inexperience, and absence of a structure to assure long-term accountability for the maintenance of a site all conspired to produce meager results.

A report by the Staff of the Bay Conservation and Development Commission (BCDC 1988) evaluated the success of 14 permit-associated mitigation programs involving tideland restoration in San Francisco Bay. They reported that "mitigation programs can and, in most cases where work has been adequately performed, have successfully created and enhanced Bay resources." However, their criteria for success were based on whether a completed project met the permit's specific mitigation requirements, rather than how well it replaced or offset the specific, adverse Bay-related impacts of that project (compliance vs. functional success as described by Quammen 1986b). They noted (BCDC 1988) that "while many of the mitigation projects were successful, some well-designed projects have yet to create the desired resources," suggesting the need for mitigation areas "that are larger in size and greater in resource value than the area disturbed by the . . . project." Five of the 14 projects experienced some delay in completing all or a portion of their mitigation requirements as a direct result of being unable to either find and/or acquire a suitable restoration site. The report recommended a number of ways to increase overall success including increased attention to enforcing mitigation requirements, greater specificity in prescribed mitigation plans, and requiring that mitigation work begin prior to undertaking the actual permitted project.

In a comprehensive Florida study, the Florida Department of Environmental Regulation (FDER) revisited 119 habitat-creation, enhancement, or preservation sites covered under 63 permits (*unpublished report* submitted to Governor L. Chiles [5 March 1991]).⁴ The survey found that only 6% of the permits were in full compliance, and that in 34% of the permits no mitigation had even been attempted—although losses of natural habitat had gone forward. Interestingly, permits for tidal areas fared better than freshwater sites, with 27% vs. 12% "ecological effectiveness." To counter these losses, the report suggested that more staff, greater upfront mitigation, filing-fee assessments, and administrative fines for noncompliance were needed to counter habitat losses.

Lewis (1992) combined the FDER study findings with data from two other Florida studies of mitigation projects (D. W. Crews, *unpublished report* [Mid-project, 1990];⁵ K. L. Erwin, *unpublished report* [1991]) and reported: "Taken as a whole, these three studies looked at 174 regulatory agency-permitted mitigation projects and concluded that only eight achieved compliance with all permit requirements. That's only a 4.6% success rate . . ."

A detailed audit by the Florida Department of Environmental Regulation reviewed the specifics of >1300 permits, representing ≈10% of all dredge-and-fill mitigation permits during a 5-yr period (FDER *unpublished report* [1991; Audit Report number AR-249]) (see footnote 4). Their reviews included subsamples of permit files and compliance records as well as inspection of actual mitigation sites and interviews with applicable personnel. The audit reported inadequate record keeping and poor tracking of wetlands mitigation data, a high rate of noncompliance with permit conditions by permittees, inconsistencies in permit conditions within and among Department offices, and inadequate inspections and enforcement. For example, the audit found that 43% of the mitigated permits did not have conditions considered to be adequate and readily enforceable. Only 39% of the permittees had fully complied with the permit conditions in the required time; many projects had not even been started, while others were found to be in noncompliance for reasons including improper elevations, incorrect amounts or types of vegetation, inadequate monitoring or maintenance, and inadequate size or configuration. Only 8% of the freshwater sites and none of the tidal sites were evaluated as being *ecologically* successful, and 28% were so unsuccessful that major remedial action was recommended. The auditors concluded that "the wetlands mitigation program has generally been ineffective," and that despite some recent improvements, many problems remain.

Mager (1990) documented the existence of at least 763 permitted projects and echoed concern about the lopsided, upfront attention given to mitigation proposals as compared to follow-up: "There is virtually no follow-up once a permit is issued and the ultimate fate of thousands of acres of wetlands is unknown." These concerns are especially serious when one considers national trends. As noted by Zedler (1996a), a U.S. Environmental Protection Agency (EPA) review of permit records for eight states over the past two decades documented 724 permits in the cumulative record, with 898 wetlands impacted and 745 compensatory wetlands required.

The serious shortcomings of mitigative activities

³ Available from Mana-Sota-88, 5314 Bay State Road, Palmetto, Florida 34211 USA.

⁴ Available from South Florida Water Management District, 3301 Gun Club Road, P.O. Box 24680, West Palm Beach, Florida 33416-4680 USA.

⁵ *Unpublished report* (1987) to U.S. Fish and Wildlife Service, Corpus Christie, Texas, USA.

⁶ Available from Florida Department of Environmental Regulation, Tallahassee, Florida, USA.

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* Based on cumulative record, undeniably poor samples of success, many failures or design, poor tours, incorrect characteristics of exotic species of nature, or developmental intention to identifying a poor performance both unnecessary it is time to and our ability fashion. comes a time to resource scientific retained science whether adequate mitigation escalating efforts and the mitigation more important

have also been expressed by others (Newman 1986). Recently, the Committee on Restoration of Aquatic Ecosystems advised against the use of wetland restoration to offset or justify the destruction of other wetlands until wetland restoration science has moved from trial-and-error process to a more predictive science (NRC 1992). Subsequently, a review article in *Science* noted the sober reality that under present mitigation policies and practices "losses are likely to be uncompensated for and that what we call mitigation has a high chance of failure" (Roberts 1993). Experts interviewed for that article expressed the consensus that compensatory mitigation should be the last resort, and must be based on the best available science, with strict, agreed-upon standards to judge success, perhaps by a government agency or private groups, and a commitment by developers to make mid-courses corrections when needed—what Zedler calls 'adaptive management' of the ecosystem." Furthermore, the article concludes with the suggestion that regulatory agencies should require, whenever feasible, that the replacement wetland be completed up front, before the natural one is destroyed.

DISCUSSION

Based on over a decade of survey results, the cumulative record of past mitigation projects remains undeniably poor overall, with disappointingly few examples of success. With hindsight, there are undoubtedly many persuasive explanations for poor performances or partial successes—including inadequate design, poor hydrology, improper location, wrong contours, incorrect elevation, small size, poor sediment characteristics, lack of skill by constructors, invasion of exotic species, exposure to severe storms, vagaries of nature, or surveys performed too early in the developmental stage to demonstrate success. It is not our intention to reanalyze past projects with the goal of identifying and systematically ranking the reasons for poor performance. In our opinion, such a task would be both unnecessarily costly and unproductive. Rather, it is time to admit the limitations in both our knowledge and our ability to gain additional information in a timely fashion. As discussed by Ludwig (1993), there comes a time when it is advisable to seek resolution to resource management issues outside the traditional scientific realm. While there is certainly need for continued scientific and on-site research, it is *doubtful whether additional scientific information will be sufficient to resolve the current problems of compensatory mitigation* or make it more effective. In the face of escalating political attacks on wetlands protection efforts and the apparent necessity of continuing to use mitigation as a wetlands management tool, it is arguably more important to explore ways to improve overall mitigative performance as soon as possible. It is also important to acknowledge a number of real-world com-

plications that are likely to frustrate attempts to improve compensatory mitigation policies and practices.

Tensions between a landscape approach and existing permit policies

Over the years the conceptual view of environmental impacts has evolved significantly, from an early perspective that assessed mainly direct project impacts, to a later view that focused on cumulative impacts, and most recently to a landscape approach. This evolution in perspective has not been accompanied by corresponding shifts in the wetlands permit process. For example, there is considerable debate about the correct scale over which to evaluate wetland functions and impacts to them. Bedford and Preston (1988) and Zedler (1996b) argue persuasively that the inability to document cumulative impacts has resulted in a continued focus on impacts bounded by the arbitrary definitions of a given project, without proper consideration of the linkages between communities and ecosystems. This disparity between landscape planning goals and individual projects often conflicts with individual property rights, thereby setting severe limits on the use of landscape approaches with compensatory mitigation.

The problem is largely a social one; we are a society that has not progressed past the frontier economics that initially categorized wetlands as a resource to be reclaimed, and that emphasizes private-sector goals over public concerns (M. E. Colby, *unpublished report*).⁷ How, in the absence of strict environmental oversight, can a landscape approach be utilized in compensatory mitigation? Barring significant erosion of private property rights, we submit that it cannot. Depending on the scale chosen, landscape management may encompass literally thousands or millions of individual property owners. Taking a large-scale, ecosystem approach to wetlands management is a significant change in natural resource management policies, one representing a major paradigm shift that will require radical revision in values, management practices, and institutional structures in order to succeed (Cortner and Moote 1994).

Maintaining consistency in the permit process is critical if we wish to avoid problems caused by conflicts with private ownership and questions over legal "taking" of land or inequitable government compensation for land in question. Thus, integrating ecologically relevant concepts such as landscape-scale decision criteria need more than good science; it will also require conscious redesign of the entire permitting infrastructure to avoid legal challenges. If developers are not offered what they perceive as rational alternatives, we should not be surprised to see them respond by litigating against compensatory mitigation (Wilmar 1986).

⁷ Policy planning and research working paper series, publication number WPS 313. Available from Strategic Planning and Review Department, The World Bank, New York, New York, USA.

Currently, review of mitigation requests is on a case-by-case basis (and will likely remain so for a long time), a process that explicitly recognizes private ownership of land and presumably treats all projects with the same set of guidelines or requirements. Adopting a landscape approach to compensatory mitigation may generate unanticipated legal complications. For example, later permittees might face more stringent controls or requirements because of cumulative impacts to the regional ecosystem caused, in part, by earlier permittees. For the landscape approach to guide compensatory mitigation projects, there must be an acceptable mechanism to justify changes in permitting criteria while balancing individual property rights. The practice of adaptive management—utilizing post-approval monitoring, changes in performance standards, revisions of compliance criteria, and repeated corrective measures—could result in charges of inconsistency or capriciousness if regulators repeatedly change the rules and requirements for permit holders.

Exemptions, small cumulative losses, and continued erosion of the wetlands baseline

Gladwin and Roelle (1992) noted that exemptions under the Corps of Engineers Nationwide Permit 26 program (authorizing discharges in "<10 acres" (4.1 ha) of wetlands)⁸ cause significant unrecorded wetlands losses from many small impacts. The current structure of permit and exemption processes virtually guarantees incremental, cumulative loss of wetlands. This means that failed mitigation projects or other small losses will not be detectable until their cumulative impact is seen on a very large scale. When detectable, these cumulative losses would indicate an alarming state of decline where remedial action is bound to be prohibitively expensive.

In some quarters there is optimism that remote-sensing technology can be brought to bear upon cumulative impact problems and landscape-scale wetlands management. In order to guide compensatory mitigation planning, the resolution of the landscape assessments must be consistent with the physical size of the compensatory mitigation projects. Rivera et al. (1992) determined that, depending on the sensing technology, 36–68% of the projects being approved for wetland alterations occurred below the detection limit of the technologies at hand. Although new technologies can provide resolution at <1-m scales, such as those being used in San Diego Bay (J. Zedler, *personal communication*), it may be some time before these are used nationwide. The sheer mass of data that would be processed for watershed-scale maps with 1-m resolution

seems sufficiently costly at present to inhibit regional planning processes. Further, expecting routine high-resolution mapping of individual mitigation projects seems unrealistic given the widespread lack of follow-up and monitoring. At least for the foreseeable future, remote sensing will probably not provide oversight data for small mitigation projects nor aid in quantitative assessment of their cumulative impacts. Without accurate information on acreages of historical and current losses, it is difficult to address questions such as "what is the baseline level of habitat?" and "to what standard do we compare the extant acreage?"

Many resource managers argue that mitigation is better than getting nothing at all in return for coastal development projects that would otherwise proceed with no recompense for environmental degradation. We disagree. In the short term, mitigation projects that do not meet the no-net-loss criteria become a liability in the effort to sustain local ecosystem functions. Over the long run, wetland management policies that allow development before the delivery of prescribed mitigative compensation contribute to the downward spiral of cumulative habitat loss. These losses may have to be offset by other projects that must provide higher ratios of replacement acreage to lost acreage for compensation. Without overcompensation through other projects, the "better something than nothing" approach constitutes a tacit approval of accepting net loss of habitat.

RECOMMENDATIONS

As described above, vexing problems continue to plague the policies and practices of compensatory mitigation. There is great difficulty in translating mitigation concepts into legal principles, regulatory standards, and permit conditions that are scientifically defensible and fair. Despite the dedicated efforts of researchers, practitioners, and regulatory officials nationwide over the past decade, there remains no universally accepted standard for required compensation—a situation that, in our opinion, is likely to persist for some time, even in the face of expanding research in restoration ecology.

While we agree there are many ways to reduce the risks of failure in wetlands restoration projects (e.g., NRC 1992: Chapter 6), it is important not to be overly optimistic that either more research, more time, more highly trained consultants, or more money will necessarily mean reduced failure rates. Even when wetland restoration experts have adequate budgets, ample time, extensive on-site experimental data, and the ability to take an adaptive management approach, functional success cannot be guaranteed (Zedler 1996b).

The permit process is still significantly ahead of the scientific debate regarding issues such as functional equivalency, biological diversity, and reconstruction of landscape patterns. Questions about substitute wetlands will no doubt continue even as additional permits are issued. Until we begin to approach at least rudimentary

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⁸ The Clean Water Act (1972) authorized the Corps of Engineers to issue permits for discharges of dredge or fill materials in the waters of the U.S. Also, the Corps was given additional permit authority in 1984 under the Nationwide Permit 26 Program (NWP 26) which allows fill of <10 acres in non-tidal wetlands.

compliance on a regular basis (such as actually initiating the work), no one will be able to determine whether these habitat exchanges can be justified on scientific grounds. Getting to compliance is the key. There is ample reason to believe that compensatory mitigation can still work—but only if we act decisively to implement some of the many insightful recommendations that have already been put forth in the literature.

Activities aimed at improving compliance

A stronger emphasis on permit compliance and enforcement is needed to improve the overall success rate of mitigation projects (Redmond 1992). Up-front completion of mitigation projects will help the situation, but only if there is some way to monitor, verify, and enforce actual compliance *prior* to commencement of the development project. Even if compliance levels eventually approach 100%, we must continue to monitor and evaluate functional equivalency of the mitigated habitat vs. the natural area that it replaces.

As noted by Lewis (1992), mitigation programs currently lack the tools necessary to enforce and ensure success of wetlands creation and restoration projects or even to see that they get done. Several factors combine to deter agencies from vigorous enforcement including the actual dollar costs of enforcement, the political costs of added staff, and the political costs of prohibiting development (Jensen 1987). Despite these problems, agencies must reconsider the issue of enforcement and monitoring, exploring ways to increase effective oversight of mitigation projects and ensure their compliance with permit conditions. Unless enforcement and monitoring are emphasized, noncompliance will likely continue as the norm, because there are no penalties or incentives for a permit holder to adhere to permit conditions.

In seeking to address the problems of noncompliance and lack of enforcement, there is need to plan carefully and avoid pitfalls associated with proposed solutions. For example, Wold (1990) described the problem caused by disparity of fine assessments for NOAA's [National Oceanic and Atmospheric Administration] civil penalty policy for overfishing. He concluded that the fines were so low in contrast to the benefits of overexploiting the resource as to not be a deterrent, and that inconsistent application of fines led to litigation because of perceived unfairness. Proposed penalties or incentives that seek to improve compliance must be considered in light of the beneficial services of functional wetlands (e.g., erosion control, primary and secondary production, aesthetics, etc.). With wetlands, various approaches that either penalize or provide incentive to a permit holder can be found, including performance bonds, civil fines and penalties, mitigation banking, and in lieu fees. Because none of these approaches, especially mitigation banking, is without problems (King 1992, Lewis 1992, King and Bohlen 1994), resource managers should review how

these alternatives contribute to overall compliance and no-net-loss-of-wetlands goals.

We strongly advocate that restoration and/or mitigation be *on site* and *in kind* as it has the greatest potential to minimize disruption of remaining ecological functions (by recognizing the importance of position in the landscape as opposed to simply quantities of habitat). This tactic should be especially emphasized in areas where significant ecological linkages and functions still exist. However, in highly disturbed settings such as urbanized areas where substantial habitat fragmentation has already occurred and ecological functions may be further impaired by the very act of mitigation (e.g., mobilization of hazardous materials during recontouring), alternatives such as mitigation banks may be a more realistic solution, albeit not without problems. Clinging to a landscape perspective in extremely fragmented or polluted settings makes little ecological sense in locations where the landscape has essentially vanished. Whatever actions are taken to increase compliance with permit conditions, they must truly lead to effective prohibition of wetlands degradation.

Clearly, alternative approaches must be executable in the face of tight budgets and conflicting agency mandates. One suggestion to improve compliance might be implementation of an approach similar to that used by the U.S. Internal Revenue Service (the tax-collection branch of the U.S. federal government), with audits, fines, and civil penalties. Such an approach may be tractable for agencies, both politically and economically. The idea is not to survey every permitted project after the fact, but to randomly choose projects and hold them to the strict criteria put forth in the permit conditions. The uncertainty of such an *audit* may well provoke much-needed attention to detail in mitigation projects. In addition, any fines that were generated for noncompliance could be used for actual habitat restoration purposes if they are so earmarked. By establishing expectations of audits for performance and compliance, repeated mistakes by unqualified practitioners would eventually be discouraged.

Budget reallocations

We recognize that any recommendation to increase monitoring, enforcement, and compliance-related activities will necessarily require a reexamination of how agency dollars are allocated. In general, agency dollars have been divided among tasks such as damage assessment; permit reviews and negotiations; inventory and resource surveys; research and development; and, to a lesser extent, enforcement and compliance. Assuming that increased funding will not be available, it may be necessary and advisable to reallocate funding in ways that emphasize permit compliance, even if this means de-emphasizing some research and inventory tasks, especially coarse-scale, dated inventories.

*Focus on generated acreage and establish
a true baseline of acreage*

Many researchers have commented on the lack of information comparing important biological functions of human-made and natural wetlands. However, in our view, concerns about function are eclipsed by concerns about generating habitat in the first place. The main priority should be on actually generating the acreage of habitat for which permits have been written. Once acreage is assured, only then does it make sense to emphasize the debate over how to measure wetland quality, function, natural equivalency, or persistence. If required acreage is not being delivered on a regular basis, then permit conditions must be strengthened.

Conclusions

As we noted at the outset, the issues in the debate over mitigation are not new, and neither are our recommendations. In fact, much of what we have discussed echoes the collective wisdom of researchers, practitioners, and agency managers, who for years have been making individual recommendations about their particular situations. The time has come to act deliberately on these collected recommendations with the aim of improving overall mitigation success. Certainly, this means applying technical skills and scientific knowledge; but it also requires an appreciation of the socio-political context of that work.

In this spirit, we suggest the need to plan strategically and prioritize actions selectively in order to realize a true no-net-loss of wetlands. We must avoid continued piecemeal revision efforts focused on technical or scientific details that are not likely to make compensatory mitigation a more effective management tool. The time has come to refocus compensatory mitigation efforts in a way that acknowledges underlying problems linked with unavoidable cultural, political, development, economic, and institutional constraints. This in no way undermines the importance of scientists or restorationists in the process; everyone must take a larger view of the mitigation process, translating and implementing their findings where appropriate. But to prevent continued losses of wetlands under compensatory mitigation, we must reorder our priorities, putting emphasis on improving compliance, generating desired acreage, and maintaining a true baseline. Unless we change the status quo of compensatory mitigation, we fear that the baseline of wetlands acreage will continue to erode in the face of faulty policies and poor implementation. We think the system is fixable, but only with deliberate, selective changes. In our optimistic moments we look forward to a time when review papers like this are not a decadal event.

ACKNOWLEDGMENTS

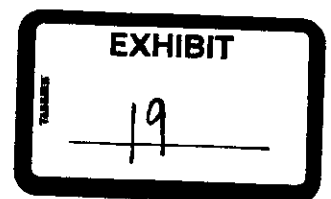
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Wetland Mitigation

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ECOLOGICAL ISSUES IN WETLAND MITIGATION: AN INTRODUCTION TO THE FORUM^{1,2}

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Abstract. Wetland mitigation projects are changing the nation's landscapes, with habitat in one area being created or restored to compensate for damages in another. Ecologists are beginning to document substantial differences between what is lost and gained in the process, and the balance sheet often comes up short. Of great concern is whether *either* wetland area *or* wetland functions are sustained by such trades. The following papers comprise a forum of responses to mitigation policies and projects. The authors are scientists who have conducted research on mitigation sites, followed mitigation projects, and/or reviewed literature on the subject.

This introductory paper defines mitigation in the regulatory context; identifies ecological issues under four headings relative to our ability to create specific ecosystems at will: predictability, structure and function, limiting factors, and landscape issues; and points out the declining status of wetlands and their nationally recognized value. The subsequent six forum papers are: Simenstad and Thom's long-term performance evaluation of a constructed tidal wetland, Bedford's discussion of hydrologic equivalence for freshwater wetland mitigation, Brinson's advice on reference wetlands, Mitsch and Wilson's reflections on how to improve functioning of mitigation wetlands, Zedler's call for regional mitigation planning in southern California, and Race and Fonseca's long-term perspective on mitigation policy.

Key words: *compensatory mitigation; constructed vs. natural wetlands; ecological issues; ecosystem development; functional equivalence; mitigation; restoration planning; southern California habitat management; status of wetland resource.*

INTRODUCTION

The United States has a "no-net-loss" policy for wetlands, endorsed by President Clinton, and mitigation plays a central role in its implementation. That is, damages to protected habitats are to be avoided, but if unavoidable, they must be mitigated (i.e., lessened) by replacement or enhancement of the resource elsewhere. Recommendations that led to this policy (NWPF 1988) and agencies that implement it (U.S. Army Corps of Engineers and the Environmental Protection Agency [EPA])³ both indicate that damages to *functions* shall be mitigated. This means that

the compensatory wetland must equal or exceed the performance of the damaged site.

Mitigation is defined as the avoidance, minimization, rectification, and reduction or elimination of negative impacts or compensation by replacement or substitution (OTA 1984). The final term, "compensation," assumes that ecosystems can be made to order, and attempts to do so are becoming common in many landscapes. Widespread concern over ineffective wetland mitigation projects (NRC 1992) suggests it is time for a forum on this subject. I begin by discussing several ecological issues under four broad categories: predictability, structure and function, limiting factors, and landscape issues.

PREDICTABILITY

Outdated ideas about community development appear to have found new advocates among authors of mitigation plans. The presumption that a site can be modified to replace a specific ecosystem, or to perform in predictable ways, is at odds with current ecological understanding of ecosystem complexity (cf. Pickett and White 1985, Botkin 1990). The old

¹ Manuscript received 23 May 1994; revised 27 December 1994; accepted 29 December 1994.

² Reprints of this 69-page group of papers on wetland mitigation are available for \$10.00 each. Order reprints from the Office of the Executive Director, Ecological Society of America, 2010 Massachusetts Avenue, NW, Washington, DC 20036.

³ U.S. Department of the Army and U.S. Environmental Protection Agency, 1990 *unpublished Memorandum of Agreement* concerning the determination of mitigation under the Clean Water Act Section 404(b)(1) guidelines.

STRUCTURE AND FUNCTION

ideas of balance, equilibrium, homogeneity, and determinism die hard (Levin 1989). Textbooks as recent as Odum's (1971) *Fundamentals of Ecology* describe community development as following an orderly progression toward a stable climax. Unfortunately for builders of wetlands, nature is not so predictable. Instead of displaying balance and equilibrium, ecosystems change from year to year and, on rare occasions they are redirected by extreme events. Instead of being homogeneous, landscapes are mosaics, especially where dominated by humans (i.e., where mitigation occurs). Today's ecological paradigms include uncertainty and variability at a variety of spatial and temporal scales (Levin 1989).

With an understanding of the limits of our ability to predict community development should come more realistic expectations about ecosystem replacement and, eventually, better decision making. Recent attempts to reintroduce single species of rare plants to their historic habitats (Falk et al., *in press*) show how difficult it is to return even a single species to an ecosystem—the plant's environmental requirements may no longer be present; its pollinators may be absent; the small-scale disturbances required for recruitment may be lacking; and exotic species may invade the transplantation site and resist eradication efforts. Replacing an entire ecosystem multiplies the difficulties.

I am frequently asked, what is "successful mitigation"? The short answer is, "providing a habitat that is functionally equivalent to the one that will be lost." In light of current ecological thinking, we need to know a great deal about an impact site in order to duplicate it elsewhere—what species are there and in what patterns, how they relate to one another and their environment, how variable they are from year to year, and how the system is influenced by rare events. When I review plans to compensate for damages, I am critical of unrealistic promises, and I do not expect to get back a carbon copy of what will be lost. The result will be different, but how different should it be to be considered a failure or "out-of-kind mitigation"? Are there reference wetlands (natural sites of the same type) nearby to judge their similarity with the mitigation site during the same time period, as historic information may not be a suitable guide for dynamic systems? With unpredictability and variability as the "ecologist's uncertainty principle" (Levin 1989), realistic wetland mitigation plans should identify the full range of potential outcomes, including what Bill Niering calls "cattailization" (i.e., dominance by opportunistic *Typha* species). Predicting the result of a mitigation project is risky, and detailed studies of constructed ecosystems (e.g., Simenstad and Thom 1996) indicate that caution is appropriate.

Ecologists recognize that duplicating an ecosystem requires reestablishment of both its structure and its functioning. To describe structure, we measure attributes such as composition and biomass at one point in time. To describe function, we examine processes that occur through time, such as persistence of species and the accumulation of biomass, or productivity. In the mitigation context, a permit to compensate for damages should include clear performance standards for both structural and functional attributes.

Although simple measures of both structure and function are needed, only the former exist. Species composition and plant cover are readily assessed, but ecologists have yet to produce simple, fast, and cheap measures of functions such as geomorphic adjustment, primary productivity, nutrient cycling, organic matter accumulation, population persistence, predator-prey interactions, resistance to exotic invaders, and sustainability. Can processes such as sedimentation and nutrient retention, which improve water quality, be estimated from easily collected information on location, size, and depth of a wetland? Can the ability of an ecosystem to persist in perpetuity be predicted from a list of plant species? Should decision makers believe claims such as those of Kel-Cal⁴ that digging a hole to allow tidal flow will increase the quality and diversity of salt marsh food chains and enhance the functional capacity of the overall lagoon ecosystem? I think not, especially when there are no agreed-upon measures to assess their achievement. Yet regulatory staff must determine not only if a function can be provided, but also whether a larger area of lesser functional value will compensate. A "mitigation ratio" must be set, depending on the perceived value of the impact site, the difficulty of replacing values, and/or the time lapse anticipated between impact and compensation (cf. Brinson and Rheinhardt 1996). This ratio is usually between 1:1 and 4:1, although it can be <1:1 (see footnote 3).

LIMITING FACTORS

Broad surveys and simple experimental approaches have been used by ecologists for decades to determine what limits the growth of populations and species groupings. In recent years, larger experimental systems (mesocosms, cf. Beyers and Odum 1993) have been employed to expand predictions to ecosystem scales. But it doesn't necessarily follow that predictions from studies of natural ecosystems or mesocosms will hold at the scale of entire wetlands or landscapes.

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⁴ A business company; see Public notice of application for permit, 19 July 1985, Application number 85-137-AA, U.S. Army Engineer District, Los Angeles, California, USA.

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TABLE 1. Wetland types in the conterminous United States. Data (for the mid-1980s) from Dahl et al. (1991).

Type	Area (10 ⁶ ha)	% of total area
Freshwater inland	39.6	
Forested palustrine		52.9
Emergent marsh		25.1
Shrubs		15.7
Ponds		5.7
Other		0.6
Estuarine coastal	2.2	
Emergent marsh		73.1
Forested/shrubs		12.7
Shoreline		9.9
Aquatic beds		4.3

by their hydrologic regimes, but we don't always know how to create the appropriate hydroperiod or currents, including pulsed events, that give an ecosystem its biological attributes. Can we figure out how to provide the necessary hydrologic regime? If the project fails in that regard, can it be fixed? How long does it take for constructed ecosystems to develop the functions of the impact site? Can we accelerate the process, using soil amendments, transplantations, weed control, and other agricultural techniques? Should mitigation ratios be raised to compensate for time lost during construction and ecosystem development? Ecological studies are needed to show what limits ecosystem development so that appropriate performance standards can be set.

LANDSCAPE-LEVEL ISSUES

The declining status of the nation's wetland resource base is what led to the no-net-loss policy and the requirement for mitigation (NWPF 1988). The existing wetland resource in the conterminous United States (Table 1) is only $\approx 47\%$ of what was present in the 1780s (Dahl 1990). Nineteen states have lost $>50\%$ of their wetland area (California tops all at 91%), and 9 states that were historically rich in wetlands have lost $>2,000,000$ ha of wetlands (Florida has lost the most: 3,758,281 ha). Losses have been greatest in states with extensive agriculture in drained wetlands (California, Ohio, Missouri, Iowa, Indiana, Illinois; Dahl 1990). Recent losses, between the mid-1970s and mid-1980s, affected 1.1% of estuarine wetlands and 2.5% of inland wetlands in the lower 48 states (area loss = 93,670 ha; Dahl et al. 1991). Like the pre-1980 losses, most (54%) of the recent losses were due to agriculture; about 5% was identified as shifts to urban use (Dahl et al. 1991).

Although a large fraction of our national wetland resource has been damaged, permits continue to be approved for dredging and filling operations. The numbers of permits processed by the U.S. Army Corps of Engineers offices can be staggering, but it is hard to determine their overall impact on the landscape. The Environmental Protection Agency has in-

TABLE 2. Geographic distribution of coastal wetlands in the conterminous United States. Data from Field et al. (1991).

Region	% of total
Gulf of Mexico	58
South Atlantic	21
Middle Atlantic	16
Pacific	3
North Atlantic	2

ventoried the Clean Water Act³ Section 404 permit records from the 1970s and 1980s from eight states (Oregon, Washington, California, Texas, Arkansas, Alabama, Mississippi, and Louisiana), documenting 724 permits in the cumulative record, with 898 wetlands impacted and 745 compensatory wetlands required (Kentula et al. 1992). Extrapolation to the national landscape is tempting, but not advisable, since there are both high regional variation and incomplete records (e.g., data from the latter five states were for fresh-water wetlands only). During fiscal year 1993, the §404 permit program allowed impacts to 5265 ha of wetlands and required mitigation totaling 6480 ha (G. E. Dickey, 14 December 1993 unpublished letter to B. M. Lambert).

These changes in land use affect the distribution of wetlands within states, but there is less obvious change at the continental scale. Per-state areas present in the 1980s are highly correlated with those of the 1780s ($R = 0.97$ for 49 states; $R > 0.99$ including the outlier, Alaska; analysis of data in Dahl 1990). Large areas of wetlands can still be found in Alaska (42.3×10^6 ha), Florida (4.5×10^6 ha), Louisiana (3.6×10^6 ha), and Minnesota (3.5×10^6 ha) (Dahl 1990). The general types of wetlands are also similar, when considered at the gross scale. Coastal wetlands have always been a tiny fraction of the nation's wetland resource; they remain in the minority, at 5% of the 41.8×10^6 ha of wetlands that remain in the lower 48 states (Table 1). The Gulf of Mexico receives 53% of all fresh-water inflow to the nation's estuaries (NOAA 1990), so it is no surprise that 61% of the nation's fresh-water marshes occur there (Field et al. 1991; Table 2).

Closer inspection is needed to see how wetland losses and mitigation projects affect habitat distribution (cf. Bedford 1996). The functional capacity of whole watersheds has changed as a result of historic drainage and development of wetlands (cf. Bedford and Preston 1988). An important ecological issue is whether wetland mitigation policy should give priority to restoring the functions previously provided, rather than attempting to replace resources that are currently being lost. This raises the issue of in-kind vs. out-of-kind mitigation, i.e., should the loss of one type of habitat be compensated by creation

³ Clean Water Act of 1977 and as amended, United States Code: Title 33.

of the same type, or by restoration of a type of wetland that has been most damaged in the past? Should decisions be based on relative abundance of existing and historic habitat types, the opportunities that exist, and the likelihood of achieving restoration goals (cf. Zedler 1995)? If sustaining biodiversity is a goal, it seems that mitigation decisions should take into account the present and historic condition of the landscape, not just the impact and mitigation sites.

Landscape issues also involve the relationship between wetlands and uplands, because mitigation for wetland losses often occurs at the expense of uplands. Some projects proposed for wetlands get moved to uplands, and other mitigation projects require that wetlands be carved out of uplands. Are these acceptable ecological trade-offs? Botanists concerned about rare upland plants in Florida would say no (cf., Falk et al. 1996). In southern California, many wetlands abut coastal sage scrub, which also provides habitat for endangered birds. Such situations obviously reduce the options for mitigation. Damage to one endangered species habitat cannot be compensated by carving up another, as the Endangered Species Act⁶ requires mitigation for damages to any species on the federal endangered species list or its habitat.

THIS FORUM

Obviously, the range of ecological issues is great, and this forum should be viewed as a catalyst for future research and discussion. In the first paper, Si Simenstad and Ron Thom present a detailed, long-term assessment of functional development of an estuarine wetland, which allows them to discuss attributes that follow clear "trajectories" toward functional equivalency with natural wetlands—and other attributes that do not. This is the most detailed, long-term evaluation of the functioning of a constructed wetland that is available. It clearly shows the complexity of ecosystem development and the difficulty of using simple assessment criteria to judge functional equivalency.

In wetlands, the most important forcing function is hydrology. Barbara Bedford discusses problems of creating the proper hydrology for wetlands, emphasizing the complex interactions between variable climate and hydrogeologic factors, which act together to create a diversity of wetland types in ways that are not yet understood. Hence, it is difficult to evaluate whether the water regimes provided a mitigation site will allow the desired ecosystem to develop.

Mark Brinson offers advice on identifying suitable reference systems as the "target" for mitigation projects. He helps answer questions about mitigation ratios—should the mitigation site be larger than the

area damaged, based on assumptions of functional impairment, or if the mitigation site functions better, can it be smaller than the area damaged? Brinson proposes comparisons with wetlands of similar type within the local landscape as a way to judge compliance.

Bill Mitsch and Renée Wilson discuss how much time is required for "successful" mitigation, noting that measuring the development of ecosystem functions is not easy. They favor approaches that allow for vegetation change (self-design) and recommend adding both experimentation and simulation modeling components to mitigation projects.

Next, I describe what may be a worst-case situation. California's wetland losses are the most extensive (91%), and in the southern part of the state every new proposal brings a controversy (and often legal action). The practice of dredging shallow-water lagoons to mitigate damages to near-shore resources is questioned, and a regional restoration plan is proposed to determine what habitat types are most needed and which systems are most suitable to provide them.

Margaret Race and Mark Fonseca assess whether procedures for implementing mitigation projects have improved in the >12 yr since Race last assessed the situation. They conclude that most are still unfulfilled and emphasize the need to enforce mitigation agreements, not just put performance standards on paper.

Our contributions do not answer all the questions we have posed as ecologists. Rigorous research on wetland restoration construction is inadequate to provide simple formulas for constructing one wetland to compensate for functions lost in destroying another. Our discussions of restoration sites do suggest several conclusions that are pertinent to applied ecologists, funding agencies, and natural resource managers: (1) There is a great need for research on how to identify and measure the functions of wetlands, especially attributes that are valued by the public. (2) There is a need for more long-term, functionally based assessments of constructed wetlands. (3) Ecosystems are complex, and mitigation projects offer a wealth of opportunities to conduct wetland research. (4) Because mitigation for losses to wetlands often comes at the expense of uplands, landscape-scale evaluation of mitigation activities is essential, not only to understand their impact, but also to direct the location and type of future mitigation efforts. (5) Many ecologists are uneasy about compensatory mitigation as a means of sustaining biodiversity.

ACKNOWLEDGMENTS

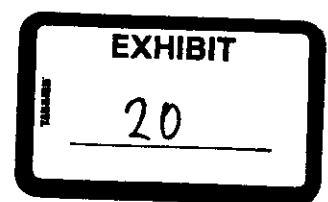
I am grateful to Si Levin for facilitating this forum on wetlands mitigation. I deeply appreciate the other authors' time and effort, and their patience through a lengthy review and coordination process. I thank John Callaway, Barbara Bedford, and Bill Mitsch for reviewing my comments.

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⁶ Endangered Species Act of 1973, United States Code: Title 16: Sections 1531 et seq.

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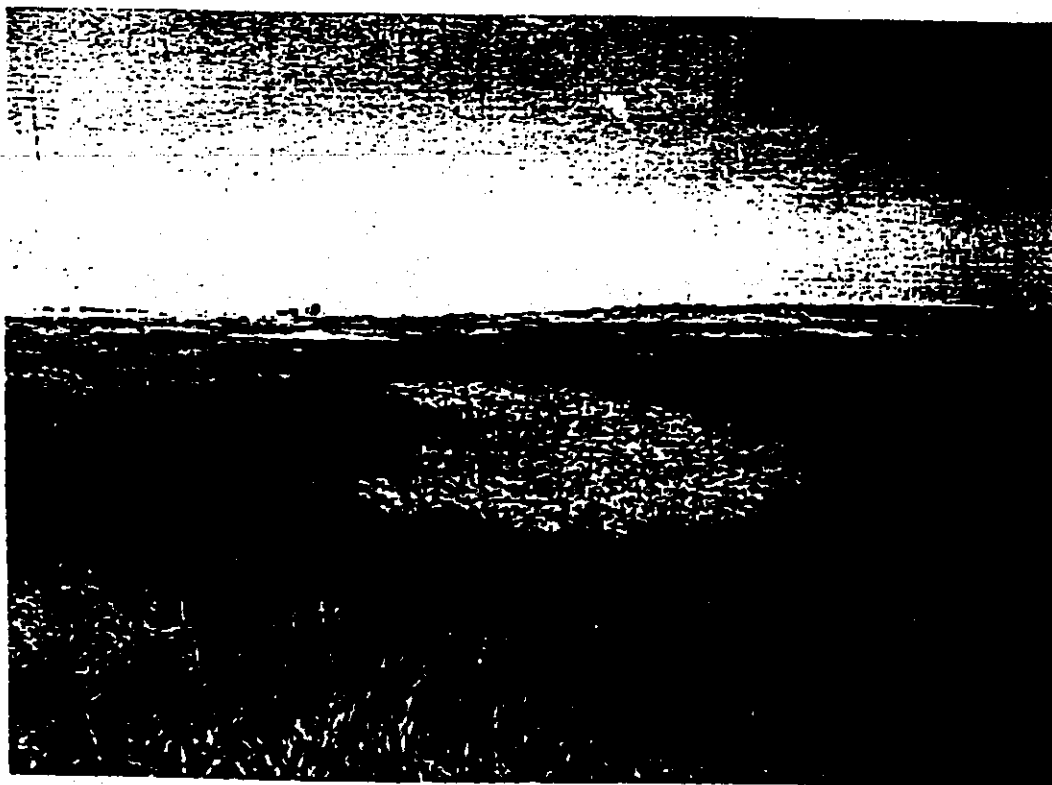
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U.S. FISH AND WILDLIFE SERVICE
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SACRAMENTO FIELD OFFICE
SACRAMENTO, CALIFORNIA



Wetland Losses Within Northern California
from Projects Authorized under
Nationwide Permit No. 26



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INTRODUCTION

Wetlands are extremely important ecosystems. They provide vital habitat to millions of waterfowl, shorebirds, wading birds, and other bird species. A tremendous number of other invertebrate, fish, amphibian, reptile, and mammal species depend directly on wetlands for all or part of their life requisites. In California, over 50 percent of federally listed endangered or threatened plant and animal species utilize wetlands. Several species proposed for Federal listing are dependent on wetlands. Wetlands contribute to habitat diversity, and increase the value of surrounding uplands to wildlife. In addition, wetlands provide other important values including water quality enhancement, water supply, recreation, and flood attenuation.

Unfortunately, California wetlands are imperiled. Between the 1780's and the mid-1980's, approximately 91 percent of California's wetlands were destroyed. The extent of riparian woodlands in the Central Valley has been reduced by approximately 98 percent. The number of vernal pools, a unique type of seasonal wetland in the Central Valley, has been estimated to have declined by approximately 90 percent (Holland 1988).

Section 404 of the Clean Water Act, as amended, authorizes the Department of the Army to issue permits for the discharge of dredged or fill material into waters of the United States, including wetlands. The Corps of Engineers (Corps) administers the 404 program for the Department of the Army. Individual permits are to be issued only if in compliance with the Environmental Protection Agency's 404(b)(1) Guidelines, which provide the criteria for evaluation of permit applications.

Section 404 of the Clean Water Act and Corps regulations allow "general permits" to be issued. General permits may be issued for categories of activities that are "substantially similar in nature and cause only minimal individual and cumulative environmental impacts" [emphasis added]. A nationwide permit is a form of general permit used to authorize activities throughout the nation. Nationwide Permit Number 26 (NWP 26) authorizes the discharge of dredged or fill material into headwaters and isolated waters provided the discharge does not cause the loss of more than 10 acres of waters of the United States. Projects seeking authorization under NWP 26 receive considerably less scrutiny and evaluation through the Corps' regulatory program. The public is excluded from the NWP 26 review process, agency review time is shortened, and fills of less than one acre meeting the NWP 26 criteria can proceed without notification of the Corps provided certain conditions are met.

Because of the tremendous wetland losses in California, and the attendant decline of fish and wildlife in the State, the Service is extremely concerned about the impacts of projects authorized under NWP 26. Beginning in 1987, the Fish and Wildlife Service's Sacramento Field Office (Service) began keeping records on projects within its work area authorized and proposed for authorization under NWP 26. This report presents an analysis of these records.

determined by the Corps to require an individual 404 permit were deleted from consideration in this analysis.

Not all acreage subject to the Corps' jurisdiction under NWP 26 is considered wetland by the Corps. Some of the acreage claimed by the Corps as being within their jurisdiction is classified by the Corps as "other waters." However, nearly all jurisdictional acres affected by projects authorized by NWP 26 are considered wetlands under the Service's wetland classification system (Cowardin et al 1979). Therefore, all acreage losses in this report are given in terms of wetland acres.

In addition, rather limited geographic areas appear to encompass especially high numbers of projects authorized or proposed for authorization under NWP 26. Therefore, the database files were examined to determine the number of projects and wetland acres lost by such projects in the following areas:

- 1) Santa Rosa, Sonoma County;
- 2) Chico, Butte County;
- 3) Roseville/Rocklin/Granite Bay, Placer County;
- 4) Folsom, Sacramento County;
- 5) Laguna/Strawberry Creek watersheds, Sacramento County.

RESULTS

Analysis of the Sacramento Field Office's database files revealed that during the six-year period between 1987 and 1992, 775 projects were authorized under NWP 26, resulting in the loss of at least 724.77 acres of wetlands within the Sacramento Office's geographic work area (Table 1, Figure 2). The San Francisco District of the Corps authorized 351 projects, resulting in the loss of 257.68 wetland acres. The Sacramento District of the Corps authorized 424 projects, resulting in the loss of 467.09 wetland acres. Figure 3 shows wetland acres lost to projects affecting less than 1 acre and projects affecting between 1 and 10 acres, by Corps District. Trends in NWP 26 authorizations illustrated in Figure 4 show an increase in projects causing the loss of between 1 and 10 acres within the Sacramento Corps District's jurisdiction. Authorizations for projects causing the loss of less than 1 acre in both Corps Districts, and projects affecting between 1 and 10 acres of wetlands in the San Francisco District Corps' jurisdiction, show a declining trend.

It is critical to remember that these figures represent only wetlands lost within the Sacramento Field Office's work area, and do not represent total wetland acreage losses in the State of California nor within the total jurisdictional boundaries of either the San Francisco or Sacramento Corps Districts.

It should be clearly understood that the results presented here should be considered to represent the minimum level of impact from projects authorized by NWP 26. Actual wetland losses are likely higher. Reasons for this include the following:

1. There is no requirement for a project proponent to notify the Corps about wetland fills or alterations that affect less than one acre. Consequently, the Service's databases do not include such losses.
2. The database only includes those projects for which the Service received a Pre-Discharge Notification or notification letter from the Corps. There are undoubtedly other projects that have been authorized by the Corps, but for which the Service received no notification. For instance, the Sacramento District temporarily stopped sending us notification letters in 1991, due to staffing limitations. Also, applicants seeking project authorization pursuant to NWP 26 may presume their projects are authorized, if their notifications to the Corps are not acted upon by the Corps within 30 days. It is unknown

if the Corps formally notifies the project proponent (and hence the Service) of authorization in those cases where the Corps has not acted within the 30-day review period.

3. For those projects affecting less than 1 acre of wetland, the Corps frequently does not indicate the actual acreage affected. In those situations, a maximum of 0.5 acre of wetland or stream was assumed to be lost. This is considered to be a conservative assumption, because for those projects in which the acreage was reported, the average was 0.52 acre. In addition, many developers and consultants are aware of the 'under an acre rule', consequently many projects involve just under an acre of fill (e.g., 0.99, 0.98, 0.97 ...).
4. In northern California, because of its semi-arid climate, many wetlands are ponded or saturated only seasonally, are difficult to identify, and are often mistaken for uplands during dry intervals. During project design and implementation, the full areal extent of such wetlands is often not delineated or the wetland may not be delineated at all. This has been exacerbated during the past six years because of the drought in California. In reality, many projects that are authorized because each purportedly fills less than 1 acre of wetland, often impact more, while the losses go unrecorded or underestimated.
5. Prior to the new 1992 Nationwide Permit Regulations, the area of wetland impact considered for the purposes of NWP 26 was generally limited to the footprint of the fill, even though additional acres of wetlands may have been eliminated from project construction. This was particularly true for seasonal wetlands and vernal pool complexes that were hydrologically linked to and biologically interdependent on the surrounding "upland" habitat. The footprint of a fill may have covered only a few acres of jurisdictional wetlands, but the direct and indirect ecological impacts to wetlands may well have exceeded that. The new Nationwide Permit Regulations do provide for consideration of adverse impacts to wetlands from excavation, flooding and drainage. However, indirect impacts from project construction are often difficult to identify and wetland losses still may be underestimated.
6. A number of projects authorized under NWP 26 have subsequently been associated with additional unauthorized filling. It is probable that substantial additional fill activity remains undetected because very few projects that are authorized under NWP 26 are monitored to determine if impacts are limited to those which were permitted. Unauthorized fills have not been included in the database.
7. When determining the wetland area to be affected by a project, the Corps often visually estimates the acreage involved.
8. The area determined by the Corps to be wetland and subject to their jurisdiction pursuant to section 404 of the Clean Water Act, does not always include the full extent of biological wetlands on the site. Areas considered to be wetlands by the Service may not be claimed by the Corps to be within their jurisdiction. This is particularly true for many riparian areas.
9. Not all NWP authorization data for the last one and one-half months of fiscal year 1992 has been entered into the database.

Table 2 summarizes wetland losses in five specific, localized areas in northern California. Despite the heavy losses of wetlands in these areas, the Corps continues to authorize projects under NWP 26, apparently having concluded that cumulative losses in these fast-developing areas are not significant.

DISCUSSION

Nationwide permits are intended to authorize projects that cause only insignificant environmental impacts, both on an individual and cumulative basis. The results of this analysis clearly demonstrate that projects authorized under NWP 26 have had a tremendous adverse impact on wetland resources in northern California.

Individual Project Impacts

Many individual projects authorized by the Corps under NWP 26 were the subjects of Environmental Impact Reports (EIRs). The fact that an EIR is required for a project is clear indication that the project, individually, is likely to have significant, adverse environmental impacts. And while an analysis of alternatives is required in an EIR, no analysis of practicable, less environmentally damaging alternatives is required for projects authorized pursuant to NWP 26, because such projects have been exempted from the 404(b)(1) Guidelines.

The NWP 26 has been used to authorize projects that, individually, will have tremendous adverse impacts on wetlands. As an example, the Sacramento Corps District recently granted NWP 26 authorization for a project that will eliminate over 500 vernal pools.

Cumulative Impacts

The results of this analysis also clearly show that the cumulative impacts to wetlands from projects authorized pursuant to NWP 26 have not been insignificant. This is especially true within the arid west where wetlands are often seasonal in nature and the habitat losses are often underassessed. The loss of even a few acres within California is significant when one considers that California has already lost 91 percent of its historic wetlands and 98 percent of its riparian areas, and those that remain provide crucial habitat for over half of California's endangered, threatened and rare species. Although the impacts to wetlands may seem small when compared to states relatively rich in wetland resources (e.g., Mississippi, Louisiana, Alaska), these impacts must be evaluated within the context of what little remains. Considering the scarcity of California's wetlands and their high value to fish and wildlife, the loss of as little as one acre should be considered a significant adverse impact, let alone the loss of over 700 acres.

From a cumulative loss perspective, the loss of over 700 acres of wetlands is significant. However, the significance of this figure is magnified when project impacts to associated upland habitats are considered together with the wetland losses. On many projects, wetlands constitute a relatively small percentage of the total project area. Upland impacts are typically not addressed by the Corps in the NWP 26 review process.

This review of the Nationwide Permit program in northern California has also revealed that the program facilitates piecemeal development. The brief analysis of impacts in specific geographic areas shows that over 10 acres of wetlands can be filled under several different NWP 26 authorizations with no apparent consideration of cumulative impacts by the Corps. If these same wetlands (which are often on contiguous parcels of land) were proposed for filling for a single project, an individual permit would be required, and would therefore be subject to a full 404(b)(1) alternatives analysis and full public review.

The 1- and 10-acre limitations also allow developers to reduce the acreage of wetland fill just slightly (e.g. from 10.2 acres to 9.9 acres) to avoid an alternatives analysis, full public review and perhaps preparation of an Environmental Impact Statement. Such small reductions in wetland fill,

however, may result in little overall reduction in project impacts to fish and wildlife habitat.

MITIGATION OF LOSSES

Service policy is to recommend against the authorization of projects in wetlands that are not dependent upon siting in wetlands. Thus, avoidance is the form of mitigation most often pursued by the Service for projects proposed for authorization under NWP 26. However, compensatory mitigation will be briefly discussed herein because of its high profile status in the Nationwide Permit arena.

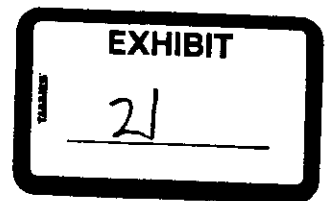
Compensatory mitigation is generally not required by the Corps for projects affecting less than 1 acre of wetlands. Thus, based on the results of this analysis, there has been a net loss of approximately 337.8 acres of wetlands between 1987 and 1992, from projects causing the loss of less than 1 acre of wetlands authorized under NWP 26 (Table 1).

Projects in the 1- to 10-acre category often have included some type and amount of compensatory mitigation. At this time, the amount of required compensatory wetland mitigation associated with these projects has not been determined. Nor can it be determined if the President's goal of no net loss of wetlands is being achieved in these cases. However, it is unlikely that the no net loss goal is being achieved, when all projects authorized with NWP 26 (i.e., <1 acre and 1- to 10-acre projects) are considered together.

Further, mitigation of wetland losses cannot be judged solely on replacement of wetland acres. Re-creation of wetland functions and values is also a key component of any equation used to determine whether the no net loss goal is being realized. It is sometimes assumed that created wetlands that resemble natural wetlands also duplicate the full range of functions of the wetlands they replaced. However, information derived from a literature review by the U.S. Fish and Wildlife Service (Schneller-McDonald et al 1990) does not support such an assumption.

Our basic understanding of the myriad of functions, processes, and interrelationships in natural wetland systems is still far from complete. Yet a complete understanding of natural wetland systems is absolutely essential before man-made imitations of these complex systems can be reasonably expected to function like natural wetlands. Ferren and Gevirtz (1990) state that, "the intricacies of the relationships between natural vernal pool habitat and vernal pool organisms may never be understood to the degree that we will know if we have re-created them." The same authors concluded that there is presently no conclusive evidence that created vernal pools will provide functional values within the range of variability of natural pools. Further, relatively few mitigation projects in northern California could be shown to be "successful", based on even relatively simplistic success criteria typically used to evaluate mitigation success. Thus, it is inadvisable to allow the destruction of natural wetlands under the presumption that we can successfully re-create the full range of wetland physical and biological functions in a man-made system.

Finally, in those cases where compensatory mitigation is required, the sole focus is typically on replacing lost wetlands. The loss of upland acres and values typically goes completely unmitigated. While upland losses have for the most part gone undocumented, it is clear that such losses are tremendous. In addition, typical wetland mitigation projects result in wetland/upland complexes having much lower ratios of uplands to wetlands than in the wetland/upland complexes destroyed by the permitted activity. Higher upland:wetland ratios generally result in higher value fish and wildlife habitat through greater interspersions of cover types, larger buffers, and adequate watershed area.



May 15, 2002

Ref: 8EPR-N

Al Pierson, State Director
Bureau of Land Management, Wyoming State Office
5353 Yellowstone, PO Box 1828
Cheyenne, WY 82003

RE: EPA's Review of the Draft Environmental Impact Statement (Draft EIS) and Draft Planning Amendment for the Powder River Basin Oil and Gas Project [CEQ #020017]

Dear Mr. Pierson:

The U.S. Environmental Protection Agency (EPA) Region 8 has reviewed the Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project. EPA's review and comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementation Regulations at 40 CFR Sections 1500-1508, and Section 309 of the Clean Air Act. BLM proposes to amend the Buffalo and the Platte River Resource Management Plans to allow coal bed methane development in the Wyoming portion of the Powder River Basin.

EPA is concurrently providing comments on a Draft EIS addressing coal bed methane development in the Montana portion of the Powder River Basin. Please see a copy of the enclosed letter to Sherry Barnett, Montana BLM Acting State Director.

Management of produced water from coal bed methane development creates an inter-jurisdictional water quality question that EPA believes needs to be addressed. We believe that this complex situation should be resolved by effective dialogue between the Bureau of Land Management (BLM) offices in both states, the State of Wyoming, and the downstream State of Montana. The downstream Crow and Northern Cheyenne Tribes should also be included in these discussions.

Our agencies made progress in that direction during our April 30, 2002, meeting in Sheridan, Wyoming, in which Dennis Hemmer and Jan Sensibaugh, Directors of the Departments of Environmental Quality for Wyoming and Montana, respectively, committed their States to assuring that the discharges of CBM-produced water would be protective of these streams present beneficial uses, such as agricultural irrigation. I personally offer my assistance to you, the States, and the Tribes in moving to a clear resolution that will protect all affected streams for all designated uses. The EPA's intent is to collaborate with all interested parties to achieve a watershed management framework that will allow coal bed methane development to occur in an environmentally sound manner.

Background Information: In the Powder River Basin, 65% of the mineral ownership is Federal. The Draft EIS predicts that coal bed methane production will proceed on 8 million acres of federal, state and private lands in Wyoming, with 51,400 projected coal bed methane wells (including 12,000 existing or permitted coal bed methane wells) and 3,200 conventional oil and gas wells. The Draft EIS projects that these wells will disturb 278,000 acres of vegetation and result in 17,000 miles of new roads, 20,000 miles of new pipeline, and 5,300 miles of additional overhead electric power lines. This project will also create facilities to provide an additional 500,000 horsepower for gas compression.

To extract methane from underground coal formations, large quantities of groundwater need to be brought to the surface. Although the produced water may be suitable for humans and livestock to drink, it is typically not suitable for irrigation. Irrigation use accounts for 98 percent of the surface water withdrawals on the Wyoming side of the Powder River Basin. Due to its levels of sodium (which is often described in terms of a sodium adsorption ratio or SAR) and salinity, coal bed methane-produced water can, if allowed to contact surface soil, permanently destroy the soil's ability to percolate water in a manner that can support

plant growth.

Alternative 1, the Preferred Alternative, proposes discharging produced water without treatment to surface streams and rivers. The Draft EIS estimates that the projected 51,367 coal bed methane wells will bring 4.4 million acre feet (192 billion cubic feet) of groundwater to the surface. A maximum yearly discharge of 381,000 acre-feet is projected for the year 2006. The Draft EIS further predicts that there will be 4,800 coal bed methane-related surface discharge locations in the Wyoming portion of the Powder River Basin.

BLM's assessment in the Draft EIS determined that if produced water is allowed to flow to surface streams and rivers, as it would be under the Preferred Alternative, it would make the Tongue River and the Belle Fourche River unsuitable for irrigation (Table S-2 on Page xxv and Page 4-64.) The SAR and salinity values predicted to occur in the Tongue River under the Preferred Alternative are inconsistent with the existing agricultural practices in the basin. These values are also inconsistent with our interpretation of the State of Wyoming's regulations, which specify that water quality degradation "shall not be of such an extent to cause a measurable decrease in crop or livestock production" and the requirement that downstream state standards be met.

EPA's rating of this Draft EIS: EPA, as part of its review process, provides a rating of the Preferred Alternative that summarizes EPA's concerns over the potential environmental impacts. We have rated the environmental impacts as Environmentally Unsatisfactory ("EU") because of impacts to irrigated agriculture. BLM's assessment of the preferred alternative states that if the full surface discharge of produced water were to be implemented, the Tongue and Belle Fourche Rivers would no longer support irrigation. Specifically, for the Tongue River, the analysis shows that the predicted levels of SAR would cause irreversible impacts to soils. Therefore, EPA is rating the Preferred Alternative as environmentally unsatisfactory. EPA recommends looking at alternatives that have fewer environmental impacts although they may have higher costs.

Our NEPA review process also calls for providing a rating regarding the adequacy of the information provided in the Draft EIS. In this case, we have significant concerns over the adequacy of the Draft EIS and have rated the document as "inadequate" ("3"). See the enclosed "Summary of Rating Definitions." A summary of our most significant concerns follows:

Range of alternatives: The Wyoming Draft EIS is considered to be inadequate because the range of alternatives did not include an alternative that would meet state water quality standards. Beyond the Preferred Alternative, Alternatives 2a and 2b, which emphasize infiltration and treatment, do not provide an analysis of impacts to water quality. In the absence of that analysis, the EIS does not demonstrate that water quality standards can be met by any alternative presented.

Impacts to the Tongue River may not meet Clean Water Act requirements. The analysis contained in the Draft EIS shows that the discharge of untreated water into the Tongue River can result in water quality unsuitable for irrigation. EPA also conducted an analysis of the impacts to the Tongue River. The EPA similarly found that if produced water is discharged without treatment, water quality in the Tongue River would result in significantly reduced crop production and irreparable soil dispersion in Montana. Applying what EPA considers to be critical flow and appropriate background water quality conditions, the predicted water quality for discharge without treatment would be inconsistent with support for the existing agricultural practices in the basin and inconsistent with both States' requirements to protect these streams for irrigation uses. The results of EPA's analysis show that only a small fraction of the produced water could be discharged without treatment before reaching the salinity and SAR cumulative effects threshold for adverse crop and soil effects. EPA urges BLM to comprehensively address the water quality issues for the Tongue River in the two Draft EISs and to prepare a predictive analysis for this river that is acceptable to the States and the Tribes.

Impacts to the Powder River and Little Powder River are not well understood. Regarding impacts associated with discharging untreated produced water, EPA's analysis suggests that the frequency of flows with salinity suitable for alfalfa irrigation may decrease. At the same time, there would likely be an increase in the volume of flow suitable for alfalfa irrigation due to mixing CBM-produced water

discharge with river flow. It is not yet understood how such changes would affect irrigation practices. EPA urges BLM to comprehensively address the water quality issues for the Powder River and Little Powder River in the two Draft EISs and to prepare predictive analyses for these rivers that is acceptable to the States.

Impacts to Belle Fourche River and Cheyenne River. Regarding impacts associated with discharging untreated produced water, EPA's analysis of the Belle Fourche River suggests that there may be a concern with potential changes to the SAR values in relation to salinity. This could potentially affect irrigation in South Dakota. EPA urges BLM to comprehensively address the water quality issues for the Belle Fourche River and Cheyenne River in this Draft EIS and to prepare predictive analyses for these rivers that is acceptable to the States.

Combined Analyses for this Draft EIS and the Montana Draft EIS should be provided: The bifurcation of the Powder River Basin into two EISs does not enable the decision-maker and the public to fully evaluate the cumulative impact of both projects. In addition, the separation of the EIS's between the two states has resulted in conflicting information. For example, for future water quality conditions in the same streams at the same monitoring locations, the analyses in the two Draft EISs differ. Another difference exists between the Reasonably Foreseeable Development (RFD) scenario for each Draft EIS. The Wyoming RFD projects much less recoverable gas than does the RFD in the Montana EIS. These inconsistencies should be evaluated and harmonized for both draft EISs. The EISs should also refer to the USGS report issued in 2001 concerning the recoverable coal bed methane for the entire Powder River Basin.

Air quality analysis needs to be provided: The Draft EIS does not include sufficient information on existing air quality trends in the Powder River Basin. Air quality conditions have changed considerably in the Powder River Basin in Wyoming in the last several years. Beginning in 1999, particulates of a size of 10 microns or smaller have been recorded at or above the Class II PSD increment, culminating in 13 exceedances of the health based standard (NAAQS) in 2001 and 2002. Impacts from the addition of 6,680 miles of unpaved roads in the Montana portion of the Powder River Basin when combined with the 17,000 miles of mostly gravel roads or dirt "two track" roads in Wyoming could further exacerbate particulate air pollution in the Powder River Basin. These events and mitigation measures should be analyzed, in consultation with the Wyoming DEQ, and included in a revised or supplemental Draft EIS.

Steps Toward Quick Resolution of Issues: We suggest the following steps for the agencies to move toward resolution of the issues discussed above:

Incorporate the existing state agreements and the water quality thresholds being prepared by the Montana Department of Environmental Quality and the Northern Cheyenne Tribe. The Montana Board of Environmental Review will shortly be presented with recommendations from the Montana DEQ regarding numeric thresholds for protection of agriculture, and with scientific information that supports those recommendations. The Northern Cheyenne Tribe has recently proposed water quality criteria for the Tongue River, based on independent scientific analysis of water quality impacts to agriculture and riparian vegetation. BLM should incorporate into its analysis the thresholds that these agencies determine are protective of designated uses, and use those thresholds as the basis for determining cumulative loading limits needed to avoid degrading the Powder River Basin watersheds.

A Watershed Management Framework should be prepared. EPA offers its assistance in preparing a watershed management framework that utilizes the scientific basis described above, and consists of the following steps: 1) setting a cumulative allowable threshold of untreated produced water as a percentage of the total water expected from the number of wells that could be reasonable foreseen, 2) defining the mix of technically feasible and economically viable water management practices other than discharge without treatment, and 3) analyzing the cumulative environmental impacts of those water management practices. By working together, we believe we can assist BLM in developing an alternative that meets water quality standards and incorporates a watershed management framework.

Include additional key information in a Revised or Supplemental Draft EIS. The EPA believes

the above watershed information, the additional air quality analysis, and the additional fish and wildlife assessment should be included in a revised or supplemental Draft EIS in order for the public to have an adequate opportunity to review and provide comments on it. BLM should (1) harmonize the two current analyses of the impacts on this basin; (2) present alternatives that industry can implement and that are sufficient to protect all affected water bodies; and (3) provide an adequate opportunity for the public to review and comment on these complex issues. Without resolution of the issues raised in this letter, the proposed amendment of these Resource Management Plans could become a candidate for referral to the President's Council on Environmental Quality.

We appreciate the opportunity to review this Draft EIS. If you would like to discuss our comments in further detail, please call me at (303) 312-6308 or Max H. Dodson, Assistant Regional Administrator for Ecosystems Protection and Remediation, at (303) 312-6598, or have your staff call Gregory Oberley, our lead NEPA reviewer for this project, at (303) 312-7043.

Sincerely,

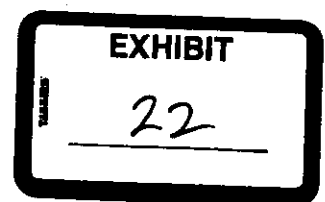
original signed by:
/s/ Robert E. Roberts

Regional Administrator

Enclosures

cc: Sherry Barnett, BLM Acting State Director , Montana State Office
Dennis Hemmer, Wyoming DEQ, Cheyenne, Wyoming
Jan Sensibaugh, Montana DEQ, Helena, Montana
Steve Pirner, South Dakota Department of Natural Resources
David Ballard, Montana Oil and Gas Commission, Billings, Montana
Geri Small, Northern Cheyenne Tribe, Lame Deer, Montana
Clifford Bird-in-Ground, Crow Tribe, Crow Agency, Montana
Keith Beartusk, Bureau of Indian Affairs, Billings, Montana

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WHOLE EFFLUENT TOXICITY (WET) TESTING OF
COALBED METHANE (CBM) PRODUCED WATER
IN
NORTHEASTERN WYOMING



Prepared by:

Wyoming Department of Environmental Quality

Water Quality Division

October 30, 2003

INTRODUCTION

The Water Quality Division (WQD) of the Wyoming Department of Environmental Quality (WDEQ) is the primary governmental agency in Wyoming with responsibility for controlling and preventing water pollution. Through the National Pollutant Discharge Elimination System (NPDES) Program, the WDEQ regulates discharges resulting from the dewatering of coal-bearing formations for the purpose of methane gas production. Based upon figures provided by the US Bureau of Land Management (BLM) and Wyoming Oil and Gas Conservation Commission (WOGCC), it was predicted in July 1999 that 5000 to 15000 coal bed methane (CBM) wells would be developed on BLM lands alone over the next ten years. That prediction was dramatically increased in the BLM's Final Environmental Impact Statement (FEIS) for the Powder River Basin Oil & Gas Project. The FEIS estimates an additional 50,000 - 80,000 CBM wells will be drilled on BLM lands in the Powder River Basin (PRB), mostly in Wyoming, by the year 2010.

The CBM gas is held in the coal seams by pressure from surrounding groundwater. To reduce the pressure and release the gas for recovery at the surface the groundwater must be pumped out of the coal seam. The groundwater removed during CBM gas recovery is referred to as CBM produced water. The CBM produced water is often directly released to surface waterways (usually ephemeral stream channels) or held in on- or off-channel impoundments. The quality of the CBM produced water is typically assessed by analyzing for dissolved ions (sodium - Na, calcium - Ca, magnesium - Mg, chloride - Cl, bicarbonate - HCO_3 , etc.), pH, sodium adsorption ratio (SAR - the ratio of Na to the sum of Ca and Mg), and electrical conductivity (EC - a measure of the ability of the water to conduct electricity).

This project was conducted because of concerns related to the CBM produced water discharges associated with the anticipated development of CBM resources in the Powder, Little Powder, Cheyenne, Tongue, and Belle Fourche River Basins in northeast Wyoming. This study was designed to examine the potential toxicity of CBM produced water, particularly in light of the multiple discharges to single drainages or tributaries that will result from CBM development, and the difficulty in assessing cumulative impacts from these discharges. The information collected as a result of these efforts will be used to facilitate a more informed approach to the development of permit limits through the NPDES process of setting waste load allocations and conducting antidegradation reviews.

Early CBM development occurred in the Belle Fourche and Cheyenne River drainages in northeastern Wyoming. CBM produced water from coal seams in these locations is typically of relatively higher quality (low SAR and EC relative to receiving waters) and direct or in-direct discharges have been permitted to ephemeral channels. Current CBM development is expanding to the north and west across the PRB and CBM produced water is being produced from several distinct coal seams. The CBM produced water from the coal seams in the central and northern portions of the PRB is generally of poorer quality than the CBM produced water in the southeastern portion of the PRB. Due to the variability of water quality and the large volume of discharge, questions have been raised about the potential toxicity of the CBM produced water.

WDEQ/WQD is addressing these questions by sampling and analyzing CBM produced water to assess potential impacts to receiving waters. One technique to holistically assess CBM produced water impacts to biological organisms in the receiving waters is the Whole Effluent Toxicity (WET) test. The U.S. Environmental Protection Agency (USEPA) recommends and has approved protocols for conducting WET tests as a component of an integrated water-quality based approach to controlling toxic discharges. Advantages of conducting a WET test using CBM produced water (or effluent) are the ability to assess the aggregate toxicity or synergistic effects of the effluent, the ability to assess the bioavailability of potential toxicants, and the ability to address unknown or unidentified toxicants that would have been missed by a standardized water quality test for individual ions. Some disadvantages include an incomplete toxicology assessment (few biological species tested), the ambient conditions may be different than the laboratory conditions, and an incomplete knowledge of the causative toxicant (additional testing may be required to identify the problem ion or ions). WDEQ/WQD selected the WET approach to assess impacts from CBM produced water as a complement to existing water quality monitoring programs.

WDEQ/WQD solicited bids from private analytical laboratories to conduct WET tests on CBM produced waters collected from the major drainages of the PRB during the summer of 2003. Two types of WET tests were conducted, a chronic and an acute. The chronic test was conducted for a relatively long period of time, 7 days, and the results were measured as mortality or sublethal effects (reproduction). The acute test was conducted over a short period of time and the measured result was mortality.

METHODOLOGY AND SITE SELECTION

WDEQ/WQD personnel selected ten (10) sites in the PRB to assess CBM produced water impacts to receiving water using the WET procedures (Fig. 1). Sites were selected to represent various coal seams and drainages in the PRB. The WET methodologies followed USEPA guidelines as described below.

Method 1 – WET Acute Testing

WDEQ/WQD personnel collected 10 grab samples of CBM effluent (produced water) from coal bed methane wells in northeast Wyoming during June and July 2003. Each sample gathered consisted of twelve (12) liters of water and was stored such that a temperature change of not greater than 4 degrees Centigrade occurred from collection during shipping and until analysis. The Laboratory conducted WET Acute tests following the protocols in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms – Fourth Edition" (USEPA 1993). The species used for the WET Acute testing included a fish (fathead minnow, *Pimephales promelas*) and two aquatic invertebrate species (*Ceriodaphnia dubia*, and *Daphnia magna*). Acute testing of *Daphnia magna* was conducted at 100% effluent and a control.

Method 2 – WET Chronic Testing

WDEQ/WQD personnel collected 10 grab samples of CBM effluent (produced water) from the same coal bed methane wells used for the WET Acute tests during June and July 2003. The Laboratory conducted WET Chronic tests following the protocols in "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (USEPA 1994). The species used for the WET Chronic tests were the same species used for the WET acute tests with the exception of the *Daphnia magna*, which was not used for the chronic tests.

In addition to the WET test procedures, standard water quality analyses were conducted on the CBM effluent. The Standard Water Quality testing was conducted to assess the concentrations of selected parameters listed in NPDES permits issued by the WDEQ/WQD to coal bed methane operators in the PRB. The list of parameters included; Alkalinity, Hardness, Electrical Conductivity (Ec), Total Dissolved Solids (TDS), pH, Sodium (Na), Calcium (Ca), Magnesium (Mg), Potassium (K), Chloride (Cl), Carbonate (CO₃), Bicarbonate (HCO₃), Sulfate (SO₄), Nitrate (NO₃), Arsenic (As), Barium (Ba), Cadmium (Cd), Copper (Cu), Lead (Pb), and Selenium (Se). Test procedures for the analysis of parameters and holding times were in accordance with the USEPA regulations published in 40 CFR, Part 136.

Site Selection

WDEQ/WQD personnel selected the ten (10) WET sites based on several factors. The factors included: potential differences in water quality from the various coal seams in the PRB; potential impacts in drainages where concerns had been raised during the Public Notice period for NPDES permit applications or in drainages where CBM produced water volume was increasing; and a sampling pattern to ensure spatial coverage of the PRB.

RESULTS

The location, associated NPDES permit number, sampled coal seam, and the name of the major drainage sampled for each of the ten (10) WET sites are listed in Table 1. Table 2 lists a summary of the individual acute and chronic test results indicating effect, no effect, or effect for one of the species. Table 3 lists a summary of the standard water quality analyses and compares the results with the NPDES permitted limits.

The chain of custody papers are in Appendix A and the laboratory sheets for the acute and chronic test results are in Appendix B and C, respectively. The standard water quality analytical results are in Appendix D and a comparison of the results of the standard water quality analyses versus the NPDES permit limits for selected constituents are listed in Appendix E.

INTERPRETATION OF RESULTS

The testing conducted for this study was designed to assess the potential toxic effect of CBM produced water from various coal seams in northeast Wyoming on aquatic organisms. The study consisted of conducting standard water quality analyses for specified parameters and performing WET testing on selected CBM produced water samples.

The samples collected represent nine different coal seams and five major drainage systems (refer to Table 1). The selected sites represent areas of current CBM development and the coal seams from which the produced water is typically extracted. These sites were chosen to be representative of the quality of produced water throughout northeast Wyoming.

WET Testing

The first portion of the study involved conducting WET testing on the produced water samples to evaluate the potential toxic effect to aquatic life. The species used for the WET Acute and Chronic testing were the Fathead Minnow, *Pimephales promelas* and the aquatic invertebrate *Ceriodaphnia dubia*. In addition, an Acute WET test for *Daphnia magna* was conducted. The test using the aquatic invertebrate *Daphnia magna* was intended to provide a salt sensitive test species representative of what might be expected in some areas of northeast Wyoming.

Acute Toxicity Tests

The results of the toxicity tests are summarized in Table 2. For acute tests, toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration. According to the Acute results for Sites 1, 4, and 6 through 10, no mortality was observed for any of the species tested, indicating no effect to aquatic life.

At Sites 2 and 5, no mortality was observed but the survival rate of Fathead Minnows at 100 percent dilution declined to 75 percent. The cause of the decline in survival cannot be determined from the data collected. Elevated pH levels (9.07 su) and alkalinity concentrations (1200 mg/l) at Site 2 may be a possible explanation for the decline. However, additional research is necessary in order to provide a conclusive determination.

For all species at Site 3, mortality was observed at various dilutions. Mortality in *Ceriodaphnia dubia* was observed at a 50 percent dilution and for Fathead Minnows it was observed at 12.5 percent dilution. This decline in survival suggests that the produced water had an effect on aquatic organisms. According to water quality samples collected for the test, elevated pH levels (8.62 su) and alkalinity concentrations (2150 mg/l) may have contributed to the decline in survival. Again, further research is necessary in order to provide a conclusive determination.

Chronic Toxicity Tests

The results of the Chronic WET tests are contained in Table 2. For Sites 5 through 10, both species had a high percent of survival (90 percent or greater) and the mean reproduction and growth data did not indicate a significant change in reproduction or growth from controls. From this data we conclude there should not be an effect on aquatic species. Results for Sites 1, 2, and 4 demonstrated a high percent of survival (80 percent or greater) for both species tested. The mean growth rate appears to be consistent for the Fathead Minnows. The mean production rate for *Ceriodaphnia dubia* also appeared to be consistent for all dilutions of 50 percent or less. However, the mean reproduction rate for these species at 100 percent dilution (i.e., undiluted produced water); significantly declined indicating that there was an effect on reproduction of aquatic life. Chronic testing for these sites showed no effect in reproduction at dilutions less than 50 percent. The data does suggest that there was an effect on reproduction for undiluted produced water. This may have been a result of an increase in pH levels and alkalinity concentration. In addition, the drop in reproduction rates may have been an artifact of the lab procedures and may not be representative of ambient conditions. Further sampling and research must be conducted to determine the cause of the observed effect.

As seen in the Acute WET test for Site 3, the Chronic testing also indicated effects to aquatic life. Both species had a high percentage of survival (83 percent or greater) but the mean growth and reproduction declined. The reproduction declined steadily with each dilution and the growth rates decreased significantly with undiluted discharge water. As stated earlier, the high alkalinity (2150 mg/l) may be a possible explanation but additional sampling and research is necessary in order to provide a conclusive determination.

After reviewing the Acute and Chronic WET results, the produced water that originated from the Big George coal seam in the Powder River Major Drainage Basin appeared to have an effect on aquatic organisms. However, it is unclear the extent to which this effect may occur. This is apparent when reviewing the results from Sites 3 and 8. The produced water from Site 3 originated from the Big George coal seam in the Powder River Major Drainage and Site 8 is from the same coal seam in the Belle Fourche River Major Drainage. It is well understood that the quality of produced water varies with location and depth of the coal seams. Further research and sampling is necessary to determine the spatial area and depth of water withdrawal relative to the toxic effects associated with the Big George coal seam. A strategy for consideration of WET testing requirements in NPDES permits to assist in this determination is currently under development by the WDEQ.

In addition, further consideration (testing) is recommended to determine causative agents responsible for the decline in mortality (acute) for Fathead Minnows at Sites 2 and 5 and reproduction (chronic) for *Ceriodaphnia dubia* at Sites 1, 2, and 4. The factors that may have contributed to these declines will require further evaluation to ensure protection of designated uses and associated water quality standards.

Standard Water Quality Analysis

In addition to WET analysis for each outfall, water quality samples were collected for specified parameters. The water quality results were compared to effluent limits that are typically established in NPDES permits and are summarized in Table 3. The permit limits given in the table were based upon the assumption that the produced water will reach a Class 2 waterbody. These permit limits are protective of Class 2 Wyoming Water Quality standards and technology based effluent limits that are contained in Chapter 7 of the Wyoming Water Quality Rules and Regulations. Several constituents listed in Table 3 do not have a corresponding permit limit because the constituents in and of themselves do not pose a threat to water quality.

A review of the data indicated that most water quality samples were within permit limits with a few exceptions. The water quality samples taken at the ten sites reveal that effluent limits were exceeded for lead in three discharges, for arsenic in two discharges and for pH in one discharge.

The sample results for all Sites, except Sites 1 and 2 indicated that the concentration of total selenium is nondetectable which is in essence compliant with the permit limit. The laboratory detection level for total selenium is 5 ug/l, which is greater than the permit limit of 1 ug/l.

The data showed that the concentration of dissolved lead is in excess of the permit limits at Sites 1, 2, and 6, total arsenic at Sites 7 and 10 and pH at Site 3. In reviewing the dissolved lead concentrations at Sites 1, 2, and 6, all sample results were in excess of the permit limits which were based upon Class 2 water quality standards.

For Sites 7 and 10, the total arsenic results indicated a slight exceedance of the permit limits. However, the Acute and Chronic WET results for Sites 7 and 10 did not show an effect on aquatic life. Further sampling and research is needed to confirm the results.

Finally, the pH value for Site 3 slightly exceeded the permit limit. According to the Acute and Chronic WET results, the produced water had an effect on aquatic organisms. Elevated pH values may have been a contributing factor to the toxicity.

CONCLUSION

For all coal seams, except the Big George, the CBM produced water does not exhibit characteristics of toxicity to the tested aquatic organisms. One of the two samples collected within the Big George coal seam exhibited acute and chronic toxicity for all species tested. Additional research is needed to determine if the test results can be duplicated. If the test results are duplicated, the source of the toxicity will need to be identified and corrective measures taken. A strategy for consideration of WET testing requirements for NPDES permits with discharges from the Big George coal seam needs to be developed and is currently underway by the WDEQ.

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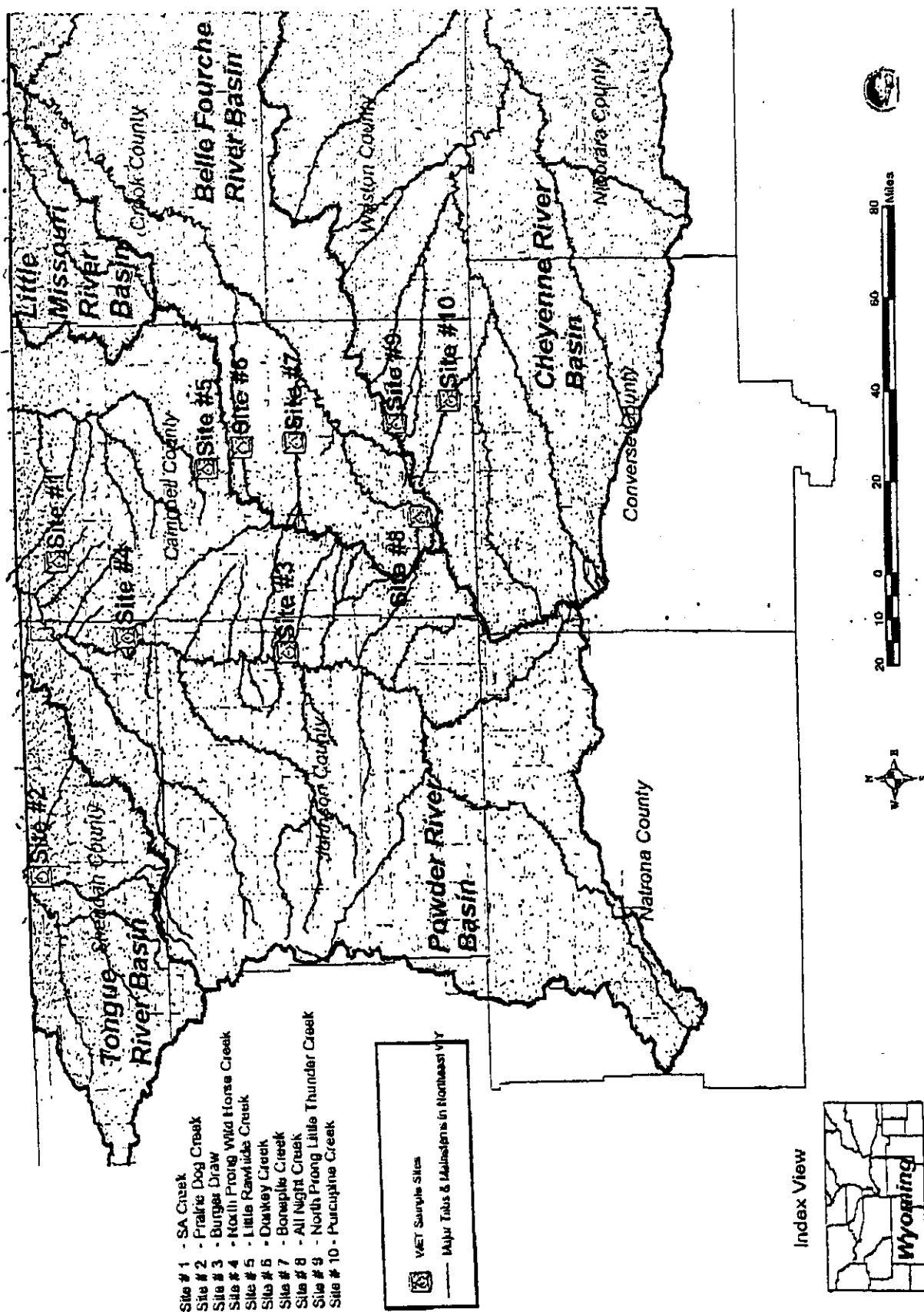


Figure 1. Location of Whole Effluent Toxicity (WET) Test Sites in northeastern Wyoming, June - July 2003.

Table 1. Location and Descriptive Information for the Whole Effluent Toxicity (WET) Sampling Sites in Northeastern Wyoming, June - July 2003.

Company	Permit #	Outfall #	Receiving Water	Coal Seam	Latitude	Longitude	Site #	Major Drainage
J.M. Huber	WY0040355	21	SA Creek	Cook/Wall/Lower Cook	44° 52' 17.30"N	105° 49' 40.36"W	Site #1	Powder River
J.M. Huber	WY0040668	1	Prairie Dog Creek	Anderson/Carmey/Monarch	44° 57' 31.22"N	106° 50' 08.14"W	Site #2	Tongue River
Anadarko Petroleum	WY0038406	3	Burger Draw	Big George	44° 08' 13.74"N	106° 07' 19.82"W	Site #3	Powder River
Pennaco Energy	WY0040827	11	N. P. Wild Horse Cr.	Anderson	44° 39' 29.80"N	106° 03' 54.32"W	Site #4	Powder River
Hi-Pro Production	WY0034312	7	Little Rawhide Creek	Fort Union	44° 23' 12.42"N	105° 32' 19.58"W	Site #5	Little Powder River
Pennaco Energy	WY0047802	2	Cortey Creek	Wyodak, Anderson, Cook	44° 18' 1.29"N	105° 28' 23.86"W	Site #6	Belle Fourche
Hi-Pro Production	WY0043141	8	Bonepile Creek	Wyodak is the major formation	44° 05' 42.26"N	105° 27' 37.81"W	Site #7	Belle Fourche
Williams Production	WY0048384	8	All Night Creek	Big George	43° 41' 03.248"N	105° 42' 10.037"W	Site #8	Belle Fourche
Williams Production	WY0039497	3	N. P. Little Thunder Cr.	Wyodak (major)/Fort Union (minor)	43° 45' 35.717"N	105° 24' 19.834"W	Site #9	Cheyenne River
Powder River Coal Co.	WY0048582	5	Percupine Creek	Wyodak	43° 34' 33.789"N	105° 20' 10.904"W	Site #10 _K	Cheyenne River

Table 2. Summary of effects for acute and chronic WET tests of CBM effluent from northeast Wyoming, June - July 2003.*

Site No.	Acute			Chronic	
	Fathead Minnow	<i>Ceriodaphnia dubia</i>	<i>Daphnia magna</i>	Fathead Minnow	<i>Ceriodaphnia dubia</i>
1	NE	NE	NE	NE	ER @ 100%
2	NE	NE	NE	NE	ER @ 100%
3	EM @ 12.5%	EM @ 50%	EM @ 100%	ER @ 25%	ER @ 25%
4	NE	NE	NE	NE	ER @ 100%
5	NE	NE	NE	NE	NE
6	NE	NE	NE	NE	NE
7	NE	NE	NE	NE	NE
8	NE	NE	NE	NE	NE
9	NE	NE	NE	NE	NE
10	NE	NE	NE	NE	NE

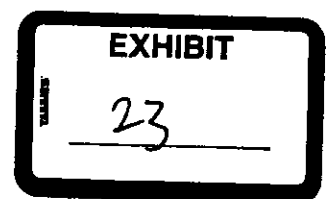
* NE = No Effect for all species tested; EM = Effect Mortality for the indicated species; ER = Effect Reproduction for the indicated species.

NE = No Effect for Acute WET tests means no dilution caused 50% mortality of test species.

NE = No Effect for Chronic WET tests means less than 20% change from controls.

Table 3. Summary of standard water quality analyses for WET test sites of CBM effluent from northeast Wyoming, June - July 2003.

Constituent	Site 1	Permit Limit	Site 2	Permit Limit	Site 3	Permit Limit	Site 4	Permit Limit	Site 5	Permit Limit	Site 6	Permit Limit	Site 7	Permit Limit	Site 8	Permit Limit	Site 9	Permit Limit	Site 10	Permit Limit
TDS (mg/L)	1198	5000	1275	5000	2365	5000	1271	5000	879	5000	948	5000	590	5000	490	5000	860	5000	553	5000
Na (mg/L)	491		508		920		523		257		285		176		154		276		149	
K (mg/L)	7		7		52		7		10		10		9		9		9		9	
Ca (mg/L)	15		6		39		14		56		75		47		22		46		26	
Mg (mg/L)	8		3		28		13		28		41		14		12		18		12	
SO4 (mg/L)	0	3000	1	3000	0	3000	0	3000	0	3000	111	3000	53	3000	0	3000	9	3000	0	3000
Cl (mg/L)	22	46	29	46	35	46	17	46	17	46	19	46	21	46	20	46	21	46	21	46
CO3 (mg/L)	0		0		384		0		0		0		0		0		0		0	
HCO3 (mg/L)	1330		1464		1842		1415		1037		866		549		573		976		683	
Hardness (mg/L)	70		27		211		88		253		354		174		104		188		114	
Alkalinity (mg/L)	1091		1200		2150		1160		850		710		450		470		800		560	
EC (umhos/cm)	1827	7500	1927	7500	3830	7500	2060	7500	1568	2200	1706	2000	1079	2000	837	2000	1433	2000	826	2000
pH, 24 hours (Std. Units)	7.52	6.5-8.5	7.75	6.5-8.5	8.52	6.5-8.5	7.76	6.5-8.5	6.7	6.5-8.5	6.84	6.5-8.5	7.05	6.5-8.5	6.78	6.5-8.5	7.26	6.5-8.5	6.76	6.5-8.5
pH, Initial (Std. Units)	7.59		7.75		8.55		7.91		7.57		7.67		7.74		7.77		8.26		7.71	
Residual Cl (mg/L)	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Initial Ammonia (mg/L)	<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05	
Final Ammonia (mg/L)	<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05	
Temp, C	5.5		9.1		2.5		2.5		2.7		2.7		2.9		8.8		8.7		9.3	
Initial DO (mg/L)	5.23		7.94		2.38		6.32		6.18		4.68		3.79		3.03		3.88		2.29	
Total Ar (ug/L)	<4	7	<4	7	<2	7	<2	7	<2	3.6	<2	3	<3	3	<3	<3	<3	<3	<3	2.4
Total Ba (ug/L)	554	1800	629	1800	213	1800	331	1800	897	1800	485	1800	240	1800	488	1800	1200	1800	565	1800
Total Se (ug/L)	<7	1	<7	1	<4	1	<4	1	<4	1	<4	1	<4	1	<4	1	<4	1	<4	1
Dissolved Cu (ug/L)	<3	1.8	<3	0.6	<1	1.8	<1	1.8	<1	1.8	<1	2.8	NA	2.8	<1	2.8	2	2.2	<1	2.2
Dissolved Cu (ug/L)	<3	9.2	<3	2.5	<3	9.2	<3	9.2	<3	10	<3	15.2	NA	15.2	<3	15.2	10	11.9	<3	11.9
Dissolved Pb (ug/L)	534	3.7	238	0.8	<0.6	3.7	<0.6	3.7	<0.6	4.1	39	6.5	NA	6.5	<0.6	6.5	<0.6	5	<0.6	5



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1

1 IN THE UNITED STATES DISTRICT COURT
2 FOR THE DISTRICT OF WYOMING

3 WYOMING OUTDOOR COUNCIL;
4 POWDER RIVER BASIN RESOURCE
5 COUNCIL; BIODIVERSITY
6 ASSOCIATES; and JERRY
7 FREILICH,

8 Petitioners,

9 VS.

CIVIL NO. 02-CV-155-WFD

10 UNITED STATES ARMY CORPS
11 OF ENGINEERS,

12 Respondent,

13 AND

14 PETROLEUM ASSOCIATION OF
15 WYOMING,

16 Intervenor.

17 VOLUME 1 OF 3
18 TRANSCRIPT OF HEARING
19 ON MOTION FOR PRELIMINARY INJUNCTION

20 PROCEEDINGS had before the Honorable William F.
21 Downes, Chief Judge for the United States District Court for
22 the District of Wyoming, on the 3rd day of February, 2004,
23 at the United States District Courthouse, Casper, Wyoming.
24
25

2

1 APPEARANCES:

2 For Petitioners:

Neil Levine
McCrystie Adams
Staff Attorneys
EARTHJUSTICE
1400 Glenarm Place, Suite 300
Denver, CO 8002

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WYCOUN2.TXT

7 THE WITNESS: Yes, Your Honor.

8 A The way we -- the way we've addressed that is we've
9 visited with the State of Colorado who has also similar
10 issues with cold bed methane and have established whole
11 effluent toxicity requirements in their permits, and so we
12 visited with them.

13 what we intend to do is to incorporate into
14 permits, in a defined area where we think we will have or
15 may have whole effluent toxicity issues -- we will be
16 incorporating WET requirements into the permit. we're in
17 the process right now of establishing what those boundaries
18 would be, what the frequency of sampling would be, what
19 species should be tested and those types of things.

20 Q Okay. Thank you, Mr. Parfitt.

21 MR. CARSON: I don't have anything further on
22 direct, Your Honor.

23 THE COURT: Cross-examination.

24 Anything else from you, counsel? Do you have any
25 questions?

TODD PARFITT - CROSS (JONES)

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1 MR. MILLER: No, Your Honor. I don't have any
2 questions. Thank you.

3 CROSS-EXAMINATION

4 BY MR. JONES:

5 Q Good morning, Mr. Parfitt.

6 A Good morning.

7 Q Mr. Parfitt, you're aware, are you not, of the -- of
8 other options to discharge CBM water besides using
9 in-channel reservoirs, aren't you?

10 A I'm sorry. I'm having difficulty hearing the question.

11 Q I'm sorry. I'll try to speak up. Are you aware of

WYCOUN2.TXT

- 12 other options to discharge CBM water besides using
13 in-channel reservoirs?
14 A Yes, I am.
15 Q In fact, isn't using off-channel reservoirs another
16 option that operators can employ?
17 A Yes, it is.
18 Q And isn't using atomizers, that is, a misting device --
19 isn't that another option that CBM operators can employ?
20 A Yes, it is.
21 Q And isn't it true that if -- if they want to, CBM
22 operators can also reinject the produced water back into the
23 groundwater?
24 A Yes.
25 Q And another option is active treatment of the water

TODD PARFITT - CROSS (JONES)

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- 1 before discharge. Isn't that true?
2 A That's true.
3 Q Now, with regard to what you regulate, Mr. Parfitt,
4 you -- you do not regulate water quantity matters at all.
5 Isn't that true?
6 A That's true with respect to what flows down the
7 channels. We do regulate flow in terms of how we establish
8 water quality-based effluent limitations, and so we do set
9 maximum levels of discharge that can occur.
10 Q A lot of these CBM discharge permits, though, you allow
11 flow of over 50,000 gallons a day per permit. Isn't that
12 right?
13 A I -- I don't know the exact figures, but that could be
14 true.
15 Q Isn't it true that you receive objections regularly
16 from landowners who are affected -- downstream landowners

WYCOUN2.TXT

11 permits.

12 Q All right. Now, isn't it true that right now in the
13 Tongue River Basin -- and I'm talking about the Tongue River
14 drainage as well as the Powder River drainage -- DEQ does
15 not allow discharges directly into those drainages or the
16 tributaries?

17 A No. That's not correct.

18 Q Well, would you say it's true that the vast majority of
19 permits for those two drainages do not involve direct

20 discharges to tributaries or on the main stem?

21 A I would say that the majority of the permits don't
22 discharge directly into the main stem of those water bodies.
23 I don't know that that's an accurate statement for the
24 tributaries, though.

25 Q Isn't -- didn't the State of Montana have a problem

TODD PARFITT - CROSS (JONES)

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1 with the effluent that was going into the Powder River Basin
2 and the Tongue River Basin and then flowing on into Montana,
3 --and didn't they raise an objection with DEQ about that?

4 A Yes, they did.

5 Q And wasn't that what spurred DEQ to then encourage the
6 discharge of effluent into these either on-channel or
7 off-channel reservoirs?

8 A The -- the result of Montana's concerns was that, yes,
9 we -- we tried to keep the discharge water out of the main
10 stems of the Powder, the Tongue and the Little Powder to the
11 extent that we can. We also established monitoring stations
12 at Decker, Montana, and Moorhead, Montana, to, on a monthly
13 basis, evaluate the water quality across the border to
14 ensure that the water quality standards at Montana were
15 being protected.

WYCOUN2.TXT

16 Q Now, right now, generally speaking, the DEQ is allowing
17 direct discharges into the Belle Fourche River drainage and
18 the Cheyenne River drainage. Isn't that right?

19 A That is correct.

20 Q And you don't want to have direct discharges into the
21 Powder River drainage because some of that effluent might
22 reach the State of Montana, and that's a problem for the
23 State of Montana. Isn't that right?

24 A That would be correct. If the water quality were to
25 change such that their standards would be exceeded at the

TODD PARFITT - CROSS (JONES)

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1 border, it would be a problem for Montana and Wyoming.

2 (There was an off-the-record discussion by
3 petitioners' counsel.)

4 THE COURT: How is this related to the permitted
5 dams and reservoir issue that you raise in your complaint,
6 counsel?

7 MR. JONES: Well, Your Honor, the -- the overall
8 point I was trying to make is that this is bad water in many
9 cases, and what -- what has happened is that they -- in
10 direct discharges, they've sort of stepped back from that.
11 They don't want to allow it. However, in -- in a couple
12 other drainages, the water quality is apparently --

13 THE COURT: But I can't charge the Corps of
14 Engineers with any dereliction, if there is any dereliction,
15 on the part of state authorities. How does that relate to
16 the Corps' abuse of its authority?

17 MR. JONES: Well, Your Honor, the overall point is
18 that the problem is not solved. And -- and the additional
19 point is that having them in -- in the reservoir -- in the
20 channels is an equally bad solution to direct discharges

WYCOUN2.TXT

- 21 A That's correct.
22 Q Had you ever visited his property before that?
23 A Yes, I have.
24 Q Did you ever work on Mr. Swartz' ranch?
25 A what do you mean by "work?"

RICHARD ZANDER - CROSS (LEVINE)

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- 1 Q Did you ever tend to the crops or rotate the cattle?
2 A No, I have not.
3 Q Prior to September of 2000, did you ever see CBM water
4 on Mr. Swartz' property?
5 A I cannot say I saw CBM water on his ranch in 2000. The
6 channel was basically dry when I was there.
7 Q Did you see any evidence of CBM water on his property
8 prior to September of 2000?
9 A I cannot answer that.
10 Q Did you or did you not?
11 A I was not there -- I was there in, you know, 1985.
12 Q Did you see CBM water in the channel in 1985?
13 A No, I did not because --
14 Q Thank you.
15 A -- there was no CBM development at that time.
16 Q Actually that leads to my next question. The FEIS that
17 your -- the BLM finalizes in -- finalized an FEIS in April
18 of 2000. Is that -- 2003. Is that correct?
19 A That's correct.
20 Q Thank you. Prior to that, you had never -- BLM had
21 never comprehensively analyzed the impacts of CBM
22 development. Isn't that correct?
23 A That's not correct.
24 Q In the State of Wyoming, had the BLM analyzed the
25 impacts of CBM development in the Powder River Basin before?

WYCOUN2.TXT

RICHARD ZANDER - CROSS (LEVINE)

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1 A Yes, we had.

2 Q In what -- what document would that be?

3 A That would have been the -- the one previous to the
4 Powder River Basin oil and gas EIS was the Wyodak EIS which
5 I was the team lead. That analyzed, I believe, two million
6 acres of potential development.

7 Q What year was that Wyodak EIS?

8 A That was written in -- the final -- the record of
9 decision was issued in November of 1999.

10 Q And prior to that, had CBM ever been analyzed
11 comprehensively by the BLM --

12 A Yes, it --

13 Q -- regarding development in the Powder River Basin?

14 A Yes, it had.

15 Q And what document would that be?

16 A Previously we -- I can go through the whole list of
17 documents that we have done if you wish.

18 Q No. That's -- that's fine. So the information was
19 available then if the Corps had wanted to contact you to
20 find out what the impacts of CBM development would have
21 been?

22 A They could have, yes.

23 Q The draft EIS, as a preferred method of disposal of CBM
24 wastewater, talked about discharging directly into the
25 streams. Is that correct?

RICHARD ZANDER - CROSS (LEVINE)

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1 A The draft EIS did, yes.

2 Q EPA, when they reviewed that draft EIS, didn't they
3 give what they call an "EU-3 rating" or an environmentally
4 unacceptable rating which is the lowest rating possible to

WYCOUN2.TXT

5 that draft EIS for discharging directly into the streams?
6 A I don't know if -- I do not know if EPA officially gave
7 us that rating. It --
8 Q Did you receive a letter --
9 A -- talked about it.
10 Q -- indicating that that was going to be -- or that was
11 their assessment of the draft EIS?
12 A We may have. I was not the team lead. I was not --
13 Q I thought you were responsible for a lot of coal bed
14 methane development, and you were about to list me a series
15 of EISs that you had looked at prior to 1999. You didn't
16 remember receiving an EPA letter dealing with the -- their
17 rating of the draft EIS?
18 A We did receive a letter from EPA, yes.
19 Q Thank you. Did you -- you changed the -- to the final
20 ROD or the final method -- preferred method of disposal; and
21 you inserted, instead of direct discharges, discharges into
22 impoundments in the final EIS. Isn't that correct?
23 A That's correct and that was done in consultation with
24 the EPA and the Wyoming DEQ. They were both cooperating
25 agencies in the document.

RICHARD ZANDER - CROSS (LEVINE)

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1 Q So it --
2 A No. I'm sorry. The EPA was not a cooperating agency,
3 although it coordinated very closely with them.
4 Q So EPA made it clear that they wouldn't approve it if
5 you had a discharge right into the creek; and, therefore,
6 you changed it so that discharges would go into reservoirs,
7 be it off- or on-channel?
8 A We changed it to respond to the comments that we got.
9 Q Did you change it so that it would be -- the preferred

WYCOUN1.TXT

9 lands where the BLM, as a part of the programmatic aspect of
10 the permit, can determine if an activity qualifies, and then
11 the -- the permittee sends a follow-up statement to the
12 Corps. So all told we have 12 records of activities that
13 were authorized by the general permit. And six of those are
14 roads; five of them are pipelines; one of them was a grade
15 control structure.

16 Q And none of those are reservoirs. Isn't that right?

17 A That's correct.

18 Q Now, isn't it true that there's a threshold for
19 notification? In other words, if the dredge and fill
20 activity is small enough, they do not have to notify under
21 the requirements of the permit?

22 A That's correct. Anything that affects less than a
23 tenth of an acre does not require prior notification.

24 Q So you at this point have no way of knowing, other than
25 doing field inspections, whether or not there's any

THOMAS JOHNSON - CROSS (JONES)

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1 reservoirs out there that come under this permit. Isn't
2 that right?

3 A We have no records on file other than our site visit;
4 and, yeah, that's -- that's basically correct.

5 THE COURT: Let me stop you. The petitioner in
6 their materials say at page 7: "GP 98-08 allows prospective
7 permittees to take advantage of GP 98-08 without anyone
8 knowing, including the Corps. The Corps will not receive
9 prior notification projects on, one, federal lands; two,
10 nonfederal lands containing federal minerals; or, three,
11 nonfederal lands with nonfederal minerals where the fill
12 activity is less than a tenth of an acre. Exhibit 5 of
13 administrative record, 575, 578."

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14 Is that a true statement?

15 THE WITNESS: That is a correct statement.

16 THE COURT: All right, counsel.

17 BY MR. JONES:

18 Q All right. Now, if you have old stock watering ponds
19 that were just used for cattle watering or other livestock
20 and those ponds are later expanded so that they can receive
21 additional quantities of coal bed methane water and that
22 expansion includes activity in the -- in the stream channel,
23 would -- would that activity be considered an oil and gas
24 activity such that it would come under the terms of
25 GP 98-08?

THOMAS JOHNSON - CROSS (JONES)

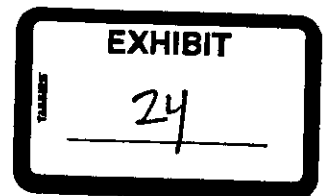
200

1 A Not necessarily, no, because there is an exemption in
2 the law for stock ponds, and under state water law the
3 beneficial use of the water has to be assigned to something,
4 and generally in most cases it's assigned to stock water.
5 You cannot build a reservoir in the State of Wyoming
6 strictly for the purpose of storing coal methane water. It
7 must be assigned some other beneficial use, and there are
8 instances where that use is for stock water and that
9 reservoir could be exempt. So the law -- the exemption is
10 not based on where the water came from; it's based on how
11 it's used.

12 Q Do you remember, Mr. Johnson, that you and I exchanged
13 some e-mails before this litigation was filed regarding
14 GP 98-08 and how it was applied?

15 A I recall that exchange, yes.

16 Q All right. On December 6, 2001, I have here an e-mail
17 from you where you indicate that: Everyone in our office
18 agrees that if there is industry funding for a reservoir,





Montana Department of
ENVIRONMENTAL QUALITY

Marc Racicot, Governor

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2344 • Website: www.deq.state.mt.us

RECEIVED MAR 16 2003

January 2, 2001

Administrator
DEQ/WQD,
Herschler Bldg.-4W
Cheyenne, WY 82002

RE: State of Wyoming Public Hearing on Coal Bed Methane Produced Water Discharge Permits Described in Public Notices Published on August 31, 2000 (PN00-009) and September 29, 2000 (PN00-010).

Dear Administrator:

We are taking this opportunity to reiterate and expand on DEQ's previous comments on these permits.

Our primary responsibility is the protection of state waters and ensuring compliance with Montana water quality laws. Our specific concerns include protection of irrigation as a beneficial use, meeting Montana's nondegradation requirements for flow and toxic parameters, and development of a TMDL for the Powder River.

As we stated in attachments to our previous comments "it is our firm belief that the proposed new discharges in Wyoming will add to the already impaired condition of water quality in Montana." EPA and Montana are currently subject to a court order that prohibits MPDES permits that would allow new or increased discharges to an impaired stream until a TMDL is in place. Our previous comments also pointed out that naturally high levels of salinity and sodium in the Powder River have already been increased by discharges from permitted facilities in Wyoming.

An analysis done in 1986 indicated that the yield of alfalfa irrigated with Powder River water may be decreased by 1 to 29 percent of the possible yield¹ due to elevated salinity. This range would apply when 30 to 5 percent of the applied water is flushed through the soil to prevent salt accumulation. Given the limited availability of water in the basin and the soil types, it is unlikely that 30 percent of the applied water can be flushed through the soil. Actual yield reductions may be about 10 percent. Another more recent analysis² indicates that the present yield reductions are about 5 percent. However, this analysis did not discuss the amount of water that would have to be flushed through the soil to result in a 5 percent reduction in alfalfa yield.

Undoubtedly there have been some decreases in the yield of alfalfa. Alfalfa is the major irrigated crop in the area. Any increase in salinity will cause further decreases in yield. The salinity of the Powder River naturally varies during the irrigation season. Limited data suggest the salinity of CBM water is lower than the present maximums in the river. The salinity of CBM water is higher than the salinity of the river during the time when the irrigators draw down the water level in Powder River. Due to the salinity of the river, irrigators do not use the water during very low flows when the salinity is highest. If the flow is "up" and the crops need water the irrigators will use the water from the latter part of March through September. CBM discharge water will cause an increase in the salinity of the river throughout the year including the times when the irrigators will be using the water. CBM discharges will also increase the

relative amount of sodium in the river and thus increase the sodium adsorption ratio (SAR). This increase is likely to cause or contribute to decreases in crop yields and may have permanent effects on soils. We believe that there has not been an adequate analysis of the effects of sodium increases in the Powder River on the use of river water for irrigation.

Because of these concerns we ask that Wyoming not issue CBM discharge permits that will increase the salinity or sodium concentrations in the Powder River. The present high levels of salinity and sodium in the Powder River will constrain or limit CBM development in Montana and these levels result in part from permitted discharges in Wyoming. We believe that Montana and Wyoming should collaborate on a waste load allocation that could be used as a basis for future permit actions in both states. The water quality data that must be considered in this effort are discussed below.

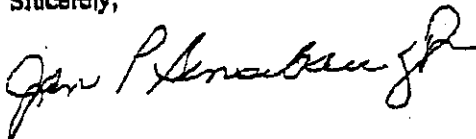
In addition to actual impacts on water uses, we must assure compliance with our nondegradation policy and rules. These rules are in the Administrative Rules of Montana at ARM 17.30.701 et seq. The pertinent requirements can be summarized as follows. No activity may cause water quality changes that exceed threshold values unless "there are no economically, environmentally and technologically feasible alternatives to the proposed activity that would result in no degradation" (ARM 17.30.706(7)) and an authorization to degrade has been granted by the department. The procedures for requesting an authorization are spelled out in the nondegradation rules.

The nondegradation threshold values given in ARM 17.30.715 include an increase or decrease in the monthly mean flow of 15%, or of 10% in the 7-day ten year minimum flow (7Q10), and an increase in the concentration of a toxic parameter that results in the instream values exceeding 15 % of the lowest applicable standard. Toxic parameters include barium, silver, fluoride, ammonia, cadmium, nickel, and lead, any of which may be present at high concentrations in some coal seam water in Montana. Numbers and parameters should be established by considering discharge water quality from Wyoming coal bed methane wells and in consultation with Wyoming officials. There may be some opportunity for seasonal limits for TDS and SAR. We are proceeding with our analysis but do not expect to have firmer numbers or parameter lists until February 2001.

As noted in one of our earlier comment letters we are concerned that the salts in the water contained in ponds will end up in the Powder River. Given that each CBM well produces about 20 tons of salt in a year we are concerned that the salts directed to the ponds remains out of the Powder River for the long term. We believe that this can be addressed by analyzing the potential for seepage of impounded water to carry salts to surface waters and the potential for impoundment failure. In addition, the long term stability and reclamation of the ponds needs to be addressed.

Thank you for the opportunity to comment, and for considering Montana's request for further dialogue on the proposed permits. Montana is committed to working with Wyoming to arrive at an appropriate approach for CBM development.

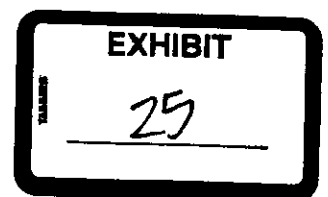
Sincerely,



Ian Sensibaugh
Director MT DEQ

- 1 Gallagher, K. 1986. Powder River Basin Water Quality Study. In-house report for Powder River Conservation District, Broadus, Montana.
- 2 Evaluation of CBM Water Discharges for compliance with Agricultural Use Water Quality – Main Stem Study, Draft Tier 1 Report (Tier 1 Report) August 1 2000

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Appendix C
Montana and Wyoming
Powder River Interim Water Quality
Memorandum of Cooperation

**MONTANA AND WYOMING POWDER RIVER
INTERIM WATER QUALITY CRITERIA
MEMORANDUM OF COOPERATION**

WHEREAS, the State of Montana and the State of Wyoming recognize a responsibility and an opportunity to cooperate work collaboratively to protect water quality in the Powder River Basin and to facilitate the development of Coal Bed Methane (CBM) activities in the respective states, and

WHEREAS, the State of Montana and the State of Wyoming will pursue a process that would establish respective responsibilities for managing and controlling salinity, SAR and other pollutants of concern; and

WHEREAS, the States of Montana and Wyoming have met in several meetings to work out the technical details of this cooperative approach; and

WHEREAS, the State of Montana and State of Wyoming realize that an interim effort is necessary until more stream flow and water quality data can be collected and analyzed to determine the assimilative capacity of waters in the Powder River drainage, and until the effects of CBM development are better known, and Montana completes the development and adoption of water quality standards, an EIS and a Total Maximum Daily Load (TMDL) plan for the basin; and

WHEREAS, the State of Wyoming recognizes Montana's downstream interests and has committed to apply certain limits on the development of CBM activities, during the term of this cooperative effort; and

WHEREAS, the State of Montana has recognized Wyoming's desire to continue to cautiously grant NPDES permits during this interim period; and

WHEREAS, the State of Wyoming has will work with and support Montana's efforts to develop long-term water quality standards and an equitable allocation of the assimilative capacity if one exists.

NOW THEREFORE, the parties enter into this Memorandum of Cooperation (MOC).

I. Parties.

The parties to this MOC are the signatories as set forth on Page 4. The director of the Wyoming Department of Environmental Quality is entering into this MOC to further the purposes of the Wyoming Environmental Quality Act W.S. 35-11-109(a)(ii). The director of the Montana Department of Environmental Quality is entering into the MOC to further the purposes of the Montana Water Quality Act , Title 75, Chapter 5, Montana Code Annotated.

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II. Purpose of MOC

The purpose of this MOC is to document the parties' commitments and their intent to protect and maintain water quality conditions within Montana during an interim period while new CBM discharges in Wyoming are cautiously allowed. At the conclusion of this interim period, the parties shall negotiate a final MOC that will include recognition of protective water quality standards and allocation of any assimilative capacity.

III. Interim Threshold Criteria for Salinity and Sodium

1. Powder River

The two states will use the highest sampled monthly values of electrical conductivity (EC) from 1990 through 1999 for the Powder River at the Moorhead gauging station as interim upper threshold criteria. Montana shall monitor the Moorhead data and report to Wyoming the average monthly EC and its comparability to the appropriate monthly value. If in any given month the average EC exceeds the threshold criteria, as listed herein, Wyoming will use its ongoing monitoring of sodium levels to determine the potential source and cause of the exceedance. The results of this investigation will be reported to Montana in a timely manner. If the exceedance is found to be attributable to CBM discharges, Wyoming will initiate appropriate steps through its regulatory mechanisms to return salinity levels into conformity with this MOC.

The Upper Threshold Salinity Monthly Values (EC in $\mu\text{mhos/cm}$) for the Powder River at the Moorhead, Montana gauging station, based on the data from the 1990's are:

January	2200
February	2300
March	2300
April	1700
May	2100
June	2200
July	2800
August	2400
September	2600
October	1900
November	2000
December	1800

The two states recognize that sodium levels and the Sodium Adsorption Ratio (SAR) may have an effect on water uses. However, at this time no clear threshold can be developed due to a lack of data. The State of Wyoming will, through its monitoring program, track sodium concentrations in the Powder River above the state line, evaluate the source of changes through various modeling techniques and report the results of these evaluations to Montana.

2. Little Powder River

The states will use statistical step tests and 90th percentile, 90% confidence limits (90/90) for EC, SAR, and Total Dissolved Solids (TDS) derived from monthly flow weighted historic data as threshold criteria to indicate whether a change has occurred. Montana shall monitor the data from the Little Powder above Dry Creek, near Weston, and report the flow-weighted results to Wyoming. The step tests and 90/90 criteria will be based on a continuous and cumulative evaluation of available data from 1985 forward. Pre-1985 data will not be used because baseline conditions delineated by the older data sets differ from post-1984 conditions. If a step test shows a significant difference or the 90/90 confidence limit is exceeded, Wyoming will conduct an evaluation as to the possible source of the trend or exceedance and report the results to Montana in a timely manner. If the difference or exceedance is found to be attributable to CBM discharges, Wyoming will initiate appropriate steps through its regulatory mechanisms to return salinity levels into conformity with this MOC.

IV. Other Pollutants of Concern

Montana accepts Wyoming's antidegradation policy as protective of Montana's water quality standards. However, should Wyoming consider an application to degrade, Montana will be included as a participant in the waiver review process so that the states may equitably allocate any assimilative capacity.

V. Monitoring Program

Wyoming and Montana are committed to the development of a monitoring program to implement this MOC and to the development of a final MOC.

VI. Standard Frequency of Data Review and Evaluation

The parties will meet periodically and review the results of their respective monitoring programs, to promptly report evaluations and results, and review the overall success of the program.

VII. Term of MOC

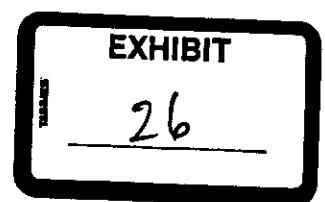
It is the intent of the parties that this interim MOC is for a period of 18 months from its' effective date. During the fall of 2002 the parties anticipate re-negotiating a final MOC that will address meeting downstream standards for the Powder and Little Powder Rivers and TMDLs.

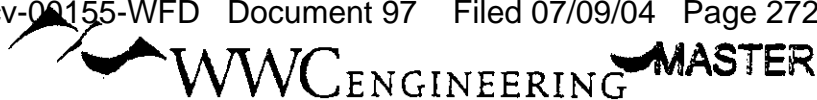
VIII. Public Participation

Opportunity for public participation was provided during the technical sessions that led up to this MOC. The parties are committed to keeping the public informed about the implementation and success of this MOC. All technical information and evaluations resulting from this MOC will be available to the public.

(September 7, 2001)

Dennis Hemmer, Director Date





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WATER MANAGEMENT PLAN
FOR SA CREEK AND LX BAR CREEK,
LX BAR CREEK POD,
RECLUSE COAL BED METHANE PROJECT

Prepared for:



A FAMILY OF SOLUTIONS

J.M. HUBER CORPORATION
2266 North Main Street
Sheridan, Wyoming 82801

March 2003

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**Water Management Plan
for LX Bar Creek and SA Creek,
LX Bar POD,
Recluse Coal Bed Methane Project**

Geographic Setting

JM Huber Corporation proposes to develop the LX Bar Creek POD within the Recluse Coal Bed Methane (CBM) project in the northern portion of Campbell County. The LX Bar Creek POD is located within the LX Bar and SA Creek drainages and will consist of 28 new federal CBM production wells located in Section 34, Township 57 North, Range 75 West and Sections 2, 3, 4, 9, 11, 13, 14, and 23 of Township 56 North, Range 75 West, in addition to the 30 existing CBM wells located in the LX Bar Creek POD. These 28 proposed federal wells are being considered for drainage impacts under the 2003 Final Environmental Impact Statement for the Powder River Basin (BLM 2003) and will be the focus of this investigation. The discharge of all produced water will be to LX Bar Creek, SA Creek, or their tributaries, all of which are tributaries to the Powder River. The general location of the study area is depicted on Figure 1. This water management plan specifically addresses only the LX Bar Creek development proposed by JM Huber and will need to be updated in the event that further development is to be taken into consideration.

The coal seams targeted for CBM production in the LX Bar Creek POD area are the Wall and lower Cook seams. The proposed wells will be dual completion wells (i.e. one hole will be drilled to produce two seams.) The coal seams targeted for production range from approximately 600 feet to 700 feet below the land surface within the development area.

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channels in areas with low channel gradients to minimize erosional degradation. Water from groups of CBM wells will be conveyed to these outfall structures in pipelines. Each outfall structure typically consists of a riprap pad surrounding the discharge pipe with a narrow scoria-lined trench sloping into the channel to prevent discharged water from eroding the channel bank. In some areas, stock tanks have been utilized to facilitate the use of CBM water for livestock use. Figure 2 depicts the typical outfall structure and Exhibit 1 shows the locations of all projected wells and their respective discharge points.

Reservoirs

There is one existing reservoir and 2 proposed reservoirs along the main channel and tributaries of LX Bar Creek and 4 existing reservoirs with 4 proposed reservoirs along the main channel and tributaries of SA Creek that may be affected by the potential CBM development (see Exhibit 1). The mean annual flow has been estimated for each of these reservoir locations without considering the storage effects from upstream reservoirs. The existing facilities are tabulated in Table 4 and the proposed facilities are tabulated in Table 5.

All of the reservoirs examined during the field investigation showed no sign of deterioration or potential failure. These structures were all given a good rating, indicating that the structural integrity appeared to be adequate for long term water storage. The spillways of these structures were also in good condition, with only minor signs of erosion from larger runoff events that activate the emergency spillway. All reservoirs receiving federally produced water within the project area will be permitted through the Wyoming State Engineer's Office. JM Huber will modify these reservoirs as necessary to make maximum

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beneficial use of the CBM discharge water. Modifications to unpermitted and permitted reservoirs necessary to handle the proposed CBM discharges will be properly recorded with the Wyoming State Engineer. Typical details for modifications to existing reservoirs are presented in Figure 3.

Table 5. Proposed Reservoirs Downstream of JM Huber CBM Development in the LX Bar Creek and SA Creek Watersheds

Watershed	Facility Name	QTR	SEC	TNP	RGE	Exhibit 1 Designation	Drainage Area (sq mi)	Mean Annual Flow (ac-ft)	AMD* (gpm)
LX Bar Creek	Reservoir 9-1	SE NE	9	56	75	9-1	0.24	11	40
LX Bar Creek	Christa Stock Reservoir	NE SE	22	56	75	Christa Stk Rsvr	0.26	12	120
SA Creek	Reservoir 2-1	NW NW	2	56	75	2-1	0.40	17	80
SA Creek	Franks Reservoir	SW SE	2	56	75	Franks Rsvr	0.57	23	40
SA Creek	Turkey Hollow Reservoir	SW NE	33	56	75	Turkey Hollow Rsvr	0.67	27	80
SA Creek	Reservoir 4-1	NE NE	4	56	75	4-1	0.04	2	40
SA Creek	Reservoir 33-1	Lot 10	33	57	75	33-1	0.37	16	80

* Anticipated Maximum Discharge from JM Huber CBM Development

Spreader Dikes

There are 16 existing spreader dikes along the main stem of LX Bar Creek and 4 existing spreader dikes along the main stem of SA Creek that may be affected by the potential CBM development proposed by JM Huber (see Exhibit 1). Spreader dikes have been historically utilized to divert natural runoff events from the stream channel onto an adjacent terrace to supplement native or improved grasses for hay production or livestock grazing. BLM

These structures present a problem for the discharge of CBM production water as they APR 02 2005 change the desired use of spreader dikes from diverting occasional flows to diverting BUFFALO F perennial flows. This change results in significant impacts to the adjacent terraces where

diversion occurs due to constant inundation and potential water quality/soil interaction concerns. Most of these structures can be mitigated by either sizing a culvert to pass only CBM flow and still allow natural flows to spill on the adjacent terraces or by cutting a v-channel around the spreader dikes. At the present time, no mitigation is necessary because the spreader dikes are located sufficiently far enough downstream that CBM flows are not expected to reach the spreader dikes. In the event that CBM discharges flow to within 300 feet of the spreader dikes, the dikes will be mitigated as described above. These facilities and their existing mitigation are tabulated in Table 6.

Table 6. Existing Spreader Dikes Downstream of JM Huber CBM Development within the LX Bar Creek Watershed

Facility Name	Watershed	Qtr-Qtr	S E C	T N P	R G E	Exhibit 1 Designation	Mitigation	Drainage Area (sq mi)	AMD* (gpm)
Spreader Dike 8-1	LX Bar	NE NE	8	56	75	8-1	Monitor	38.13	320
Spreader Dike 9-1	LX Bar	SW NW	9	56	75	9-1	Monitor**	35.04	320
Spreader Dike 9-2	LX Bar	NW SW	9	56	75	9-2	Monitor**	34.91	320
Spreader Dike 14-1	LX Bar	NW SE	14	57	76	14-1	Monitor	56.23	320
Spreader Dike 14-2	LX Bar	SW SE	14	57	76	14-2	Monitor	55.91	320
Spreader Dike 23-1	LX Bar	NW NE	23	57	76	23-1	Monitor	55.88	320
Spreader Dike 23-2	LX Bar	NW NE	23	57	76	23-2	Monitor	55.73	320
Spreader Dike 23-3	LX Bar	SW NE	23	57	76	23-3	Monitor	55.21	320
Spreader Dike 23-4	LX Bar	NE SE	23	57	76	23-4	Monitor	54.48	320
Spreader Dike 23-5	LX Bar	NE SE	23	57	76	23-5	Monitor	54.43	320
Spreader Dike 23-6	LX Bar	NE SE	23	57	76	23-6	Monitor	54.40	320
Spreader Dike 36-1	LX Bar	SE NE	36	57	76	36-1	Monitor	44.65	320
Spreader Dike 36-2	LX Bar	SE NE	36	57	76	36-2	Monitor	44.65	320
Spreader Dike 36-3	LX Bar	SE NE	36	57	76	36-3	Monitor	44.61	320
Spreader Dike 36-4	LX Bar	SE NE	36	57	76	36-4	Monitor	44.47	320
Spreader Dike 36-5	LX Bar	SE NE	36	57	76	36-5	Monitor	44.42	320
Spreader Dike 12-5	SA	SW NW	12	56	75	12-5	Monitor	1.7	220
Spreader Dike 2-1	SA	SE NE	2	56	75	2-1	Monitor	32.1	320
Spreader Dike 34-1	SA	Tract 43	34	57	75	34-1	Monitor	41.3	640
Spreader Dike 34-2	SA	Tract 43	34	57	75	34-2	Monitor	41.3	640

* Anticipated Maximum Discharge from JM Huber CBM Development

** Existing channel has cut a natural waterway around the spreader dike, but has resulted in a headcut downstream. These headcuts will be addressed in a later section.

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headcuts will be remediated by sloping the headcut back from its base at a 10H:1V slope or flatter to catch the existing channel slope upstream. The side slopes will be graded to an approximate 4H:1V slope where possible to catch the existing side slope up the bank. The disturbed area will be covered with a biodegradable erosion control fabric secured with appropriate anchors until vegetation is re-established. The seeding mixture used for revegetation will be a fast growing salt tolerant species native to the area. The resulting configuration from a typical headcut remediation is depicted in Figure 4.

Off-Channel Pits

Three proposed off-channel containment pits will be excavated in areas of subdued topography within the LX Bar POD as shown on Exhibit 1. The off-channel containment pits will be total containment units, therefore, no water will be discharged from the containment pits. Water entering the off-channel containment pits will be consumed either by evaporation or infiltration. These facilities will be permitted in accordance with the rules and regulations imposed by the Wyoming Oil and Gas Conservation Commission and the Wyoming Department of Environmental Quality.

Downstream Impacts

Specific concerns to the downstream system have been described in the previous section. These facilities will be monitored and/or mitigated in accordance with BLM guidelines. Several potential downstream impacts could result from the development of the LX Bar Creek Federal POD. The continuous flow produced from the CBM wells could create continuous discharges from existing impoundments. While small in magnitude relative to normal peak flows, the continuous discharges could change vegetation characteristics

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which in turn could affect erosional stability of spillways and natural channels. Vegetation characteristics of the active channel bottoms could change as the vegetation changes from the native grass mixtures to water tolerant species typical of intermittent to perennial streams. The change to wetland vegetation will improve erosional stability of the channels, but this vegetation may be less desirable than current vegetation types for livestock forage. There may be a short period of time within the transition period when the channel would have less vegetative cover to protect it from erosion than it would have in its current condition. Although it is not likely that this effect will be realized, JM Huber acknowledges its possibility and will monitor these areas for degradational effects. It appears that the existing reservoirs may require modification (e.g., addition of outlet pipes) prior to or during the discharge of water from CBM development as previously described. JM Huber will work with landowners to mitigate any degradational effects of CBM development on these reservoirs.

CBM discharges may also disrupt surface activities as normally dry ephemeral drainages become perennially wet due to constant discharge of CBM water. This could result in access problems for people and livestock who must cross these drainages. It is anticipated that the proposed CBM development will not affect surface grazing adjacent to or downstream of the development area with the possible exception of the immediate channel bottoms receiving CBM discharges. JM Huber will work with the downstream landowners to mitigate access problems through the installation of additional, or modification of existing, creek crossings. Any channel disturbance will be conducted in compliance with all applicable U.S. Army Corps of Engineers (COE) regulations including,

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but not limited to: prior notification, proper soil erosion and sediment controls, and COE water quality regulations.

The discharges from the wells could produce increased erosion around the discharge points and the downstream channel system. Although the CBM discharge is small relative to normal peak annual flows and the downstream channel system appears hydraulically adequate to accept the additional continuous discharge, the channel will be monitored for any degradational effects. Any accelerated erosion may affect the water quality downstream of the discharge areas in the form of an increase in levels of suspended sediments. Road crossings will need to be monitored throughout the CBM discharge duration to ensure adequate flow capacity and structural integrity.

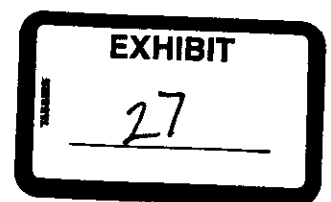
Several direct flow irrigation water rights are recorded with the SEO within the LX Bar and SA Creek drainages. Some of these water rights are permitted for irrigation use out of several of the reservoirs along LX Bar and SA Creek and for direct diversion from the main channel of the Powder River. Increased base flows and the constant flow of water as a result of the CBM development may provide more consistent irrigation and a higher potential crop production throughout the duration of CBM production for areas that have agricultural potential. However, this use will be dependent upon the sodium adsorption ratio (SAR) of the discharge water and its relation to the soils where agriculture is present.

The unadjusted SAR value for the existing water quality samples found in Attachment E is 20.2 (Lower Cook) and 19.8 (Wall) with corresponding electrical conductivity of 1,530 $\mu\text{mhos/cm}$ and 1,440 $\mu\text{mhos/cm}$, respectively. In general, waters with SAR values and EC

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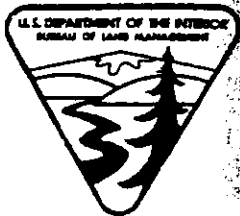




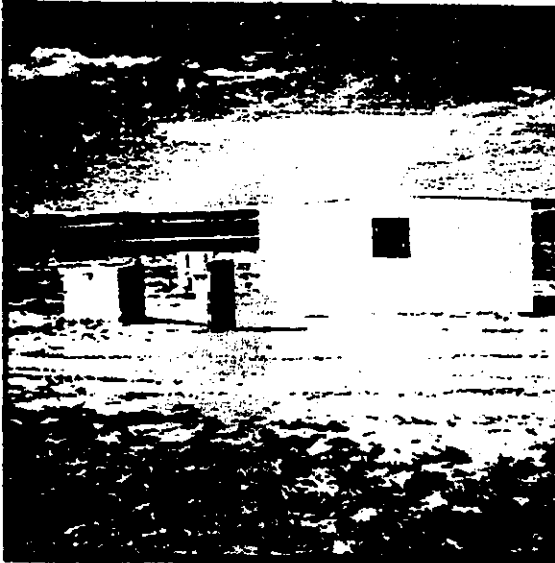
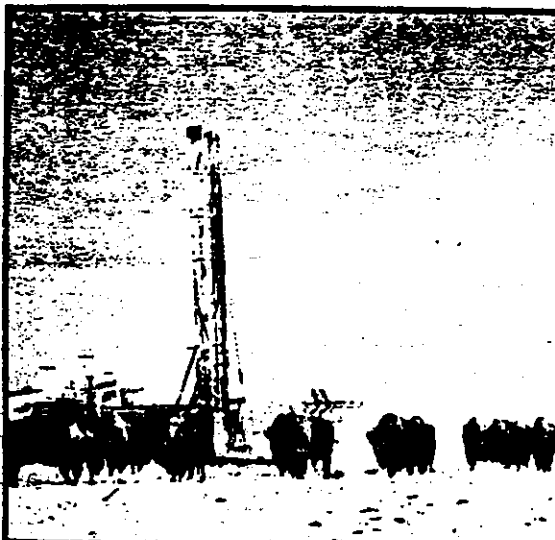
U.S. Department of the Interior
Bureau of Land Management

Buffalo Field Office

October 1999



Wyodak Coal Bed Methane Project Final Environmental Impact Statement



or Prevention of Significant Deterioration (PSD) increment analysis, may be performed. The analysis contained in this draft EIS is not intended as an air quality regulatory determination. PSD increments are used here only to evaluate air quality impacts.

PURPOSE AND NEED

The purpose of, and need for, the proposed CBM development is to allow for the orderly development of the resource to meet the energy needs of the nation. Development of federally-owned CBM also would reduce the possibility of drainage from the federal mineral estate and loss of royalties to the U.S. Treasury and the State of Wyoming. The leaseholders will be able to exercise their rights within the project area to drill for, extract, remove, and market CBM within conditions stipulated in the lease. Also included in these lease rights is the right to build and maintain necessary improvements. These rights continue throughout the lease term and any extensions or renewals granted by the appropriate authority.

The purpose of the Proposed Action is to analyze the impact of additional development of federal CBM properties within the Wyodak project area that were not analyzed in the Gillette South EIS and the Gillette North EA. This project area includes new developments within the Gillette South EIS and Gillette North EA areas and locations now being developed exclusively on state and private oil and gas leases outside these original assessment areas. An estimated 890 productive CBM wells were in place within the Wyodak project area by the end of 1998. Production statistics for 420 productive CBM wells were available for February 1998 (PI/Dwight's, 1998). Production statistics for 638 productive CBM wells were available for November 1998 (PI/Dwight's, 1999).

For the purpose of this analysis, the BLM estimates the following conditions: 1) up to one-half of all new CBM wells that would be drilled within the project area would be located on lands where these mineral rights are owned privately or by the State of Wyoming; and 2) up to one-half of all the new CBM wells that would be drilled within the project area would be located on lands where CBM mineral rights are federally owned. Drilling wells under an approved APD is the only way to determine the potential for CBM production on federal lands. The private- and state-owned gas will be developed regardless of the outcome of this decision, but under the Proposed Action the project would include development of private, state, and federal CBM properties.

The operators propose to develop CBM within the project area by increasing the total number of wells and ancillary facilities where economically feasible. This proposal would enhance recovery of methane from the project area by increasing the availability of gas supplies, thus allowing operators to provide more gas to companies distributing and supplying methane to consumers.

LOCATION OF THE PROPOSED ACTION

The proposed CBM projects are located in central Campbell and northern Converse Counties, Wyoming, within the eastern portion of the PRB. The proposals include additional development within the Gillette South EIS assessment area and the Gillette North EA assessment area, and in surrounding areas (Map 1-1). The wells would be located within a project boundary extending

Chapter 2 - Proposed Action and Alternatives

different companies, on average, each year during the initial development period of five to ten years (an estimated 7.5 years was used in the groundwater and surface water analyses); most drilling activity would occur within the initial development period; and the actual rate of development would depend on the productivity of the wells and the ability to compress and market the methane. Currently, interest in immediate CBM development is high. More than 60 companies filed APDs with the WOGCC through August 1999, for CBM well locations on federal, state, and private lands within the PRB (WOGCC, 1999c).

In addition to the proposed new wells, the Proposed Action also includes increased rates of development, CBM production, and surface water discharge and an increased area of disturbance within areas previously analyzed in the Gillette North CBM Project EA and the Gillette South CBM Project EIS (Map 1-1). Both the Gillette North CBM Project EA and Gillette South CBM Project EIS assessment areas are contained within the project area boundary for this EIS.

The proposed CBM wells would be located from approximately 33 miles north of Gillette to approximately 24 miles south of Wright, Wyoming. As stated under the "Location of the Proposed Action" in Chapter 1, the project boundary was delineated by industry interest but there is no legal requirement for companies to confine drilling to this area, other than the location of their federal leases. Under the Proposed Action, the project would include well development and production from private, state, and federal properties. However, CBM development likely would continue on private and state mineral estates, even if development of federal mineral estates were denied by the BLM.

The area analyzed under the Proposed Action (the project area) totals approximately 2,400 square miles (1,538,000 acres). Well spacing, combined with a preferred approach to locating wells, results in grouping of most wells into "pods" of about ten wells or more, depending on the structure of the coal seam. Developed areas may have up to 16 wells per square mile based on assumed 40-acre spacing. Development typically would result in wells drilled within productive portions of the project area on a spacing determined by the WOGCC. The remaining less productive portions of the project area, where initial wells do not yield sufficient quantities of CBM, may never have any subsequent activity. The average density of new wells, if all 3,000 productive wells were drilled, would be approximately 1.3 wells per square mile. Refer to Table 1 for additional information.

The BLM has a general policy that requires access roads to oil and gas wells on federal lands to be crowned, ditched, and, in most cases, graveled or otherwise surfaced. The BLM's general policy is based on the typical requirements for multi-component rigs. For CBM development, an exception has been made to this policy in consideration of the following factors. A shallow well drilling rig would be used for both drilling and completion activities. This type of drill rig and the well servicing equipment that supports its operation are modest in size, when compared with multi-component drill rigs and equipment used to drill deeper conventional oil and gas wells. Each CBM well would be drilled within one to three days. Well completion also would occur within one to three days. Typically, wellpads would not be leveled unless steep terrain could not be avoided. For producing CBM wells, on average, well service visits would be expected to occur

municipal and industrial uses. Most wells for mine facilities are completed in this aquifer. Recharge to the Tullock results from leakage through overlying strata and infiltration along the outcrop areas.

Water Use

Groundwater consumption in the study area averages 28.84 million gallons per day or 32,300 acre-feet per year (Table 3-7 of DEIS) (USGS, 1998b). More than 40 percent of this consumption is in the Belle Fourche River basin. Mining-related withdrawals associated with pit dewatering and operational consumption account for 77 percent of the groundwater use in the study area. All water for domestic consumption is derived from groundwater supplied predominantly from the Fort Union and Wasatch aquifers. Over 90 percent of domestic consumption occurs in the Belle Fourche River basin, where most of the population resides. Stockwatering and irrigation uses of groundwater accounted for slightly more than one million gallons per day in 1990.

CBM water withdrawals were not significant in 1990, and therefore, are not included in the table. However, approximately 890 productive CBM wells are in place as of the end of 1998. Produced water from the Fort Union aquifer averaged 6.92 million gallons per day based on actual reported production from 420 wells, February 1998 (PI/Dwight's, 1998).

The Wasatch and Fort Union aquifers are the most important local sources of groundwater in the PRB (Feathers et al., 1981). They are developed extensively for shallow domestic and livestock wells. Domestic and livestock wells usually are low yield, (less than 25 gpm or 0.05 cfs), intermittent producers. Water suitable for domestic and livestock uses typically can be found less than 1,000 feet below the surface. Industrial water wells are used primarily to obtain water for use in subsurface injection that promotes secondary recovery of petroleum. At coal mines these wells are used for drinking water and dust abatement. Municipal water supply wells in the project area are predominantly associated with the City of Gillette's use of the Fort Union Fm. (Tongue River, Lebo and Tullock members). Municipal water use in Gillette has a winter base demand of 3.0 to 3.5 million gallons per day (gpd) and a peak demand of 10 million gpd (Wester-Wetstein & Associates, 1994). Peak demands for the Gillette area are projected to grow to 18.1 million gpd by the year 2020 (HKM Associates, 1994).

There are more than 10,000 WSEO-permitted water wells in and around the study area (T40-58 N R70-75W; T45-56N R76W; and T48-52N R77W) of which approximately 3,600 have been canceled or abandoned. Of the remaining approximately 6,900 wells, approximately 4,000 are monitor wells. The remaining approximately 2,900 wells are used for domestic, industrial, irrigation, municipal, reservoir and stock purposes. The water well location data for all permitted water wells in Wyoming is too lengthy to include in this document but is available from the Wyoming State Engineers Office (WSEO, 1998b and 1999). Table 3-3 summarizes groundwater use in the Wyodak study area in 1990.

Chapter 5 - Consultation and Coordination

Even through water production may vary within the PRB and over time as wells continue production, it is necessary to take a hard look at cumulative groundwater withdrawals and cumulative surface water discharges. In order to analyze water volumes and water flows, these values must be estimated, even though they may be variable. The BLM has used the available data and its best professional judgement to make a representative estimate of water production for use in this NEPA analysis.

A specific mitigation plan or compensation plan for landowners is outside the authority of the BLM. The existing Water Well Agreement contained in Appendix D of the DEIS represents one such plan. It was developed by a working group of affected landowners and industry representatives (FEIS, p. 2-17).

Water Management Plans

Water management plans containing site-specific information are essential to address impacts, use/storage, mitigation, and monitoring related to water resources. These plans should be limited to BLM jurisdictional lands, developed with public involvement, and included within the EIS.

Approval of any "hydrologic watershed analysis" would exceed the BLM's authority. The BLM does not have the authority to make approval of an APD/POD dependent on the treatment of non-jurisdictional lands (off-site mitigation) in the water management plan.

Response:

As described in Appendix B, a water management plan is site-specific to a CBM Project Plan of Development (POD) for a small group of APDs, and is properly part of the APD/POD level of analysis, not this programmatic analysis for the Wyodak CBM Project (refer to FEIS, p. 1-14 and 1-15, Chapter 2, and Appendix B). A water management plan and the surface use plan it accompanies are public documents. BLM posts the non-confidential portions of APDs, (which would include surface use plans and water management plans), publicly for 30 days upon receipt. This information is available to agency decision makers and the public.

Water management plans are analysis tools that the BLM will use to address cumulative impacts of a CBM POD and reasonably connected actions site-specifically within a watershed area. As conservator of the federal mineral estate (56 percent of the Wyodak study area), the BLM retains responsibility for ensuring that the federal mineral resource is conserved (not wasted), and is developed in a safe and environmentally sound manner. The BLM does not have jurisdiction over privately-owned surface lands.

Injection of Produced Water

The EIS should evaluate injecting the produced water elsewhere in the basin for long-term storage (e.g. water banking).

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existing CBM wells and estimate how many CBM wells are expected to have discharges which exhibit toxicity. The FEIS also should disclose the mitigation plans for toxicity, i.e., no pumping allowed until toxicity is removed or an alternative disposal method is installed. It is anticipated that there may be toxicity problems from iron, manganese, and salinity. A basic plan for mitigating water quality addressing the standard requirements for mitigation of sediment or treatment of toxic discharges should be included in the analysis. The FEIS should establish some trigger levels for constituents of water discharges.

Very low selenium levels can cause adverse effects in fish and waterfowl. Reservoirs or ponds created to retain the discharge of CBM produced water may create an attractive hazard to many species of birds and wildlife through the evaporative concentration of selenium. Water should not be stored in closed impoundments.

Response:

For federal wells, water quality standards and effluent limitations in NPDES permits are administered by the WDEQ. BLM administers its resource conservation and surface protection responsibilities. CBM wells, once drilled, cannot be produced until CBM produced water can be discharged in accordance with WDEQ and other agency requirements. CBM produced water cannot be discharged unless these requirements, including treatment if necessary, are met. WDEQ reviews NPDES applications on a case-by-case basis. The agency's NPDES permitting process, effluent limitations, and monitoring requirements for CBM produced water currently are being reevaluated.

In an NPDES application, the receiving waters and the proposed effluent (CBM produced waters) are characterized by the CBM operator. This analysis is specific to a limited area, and is presented to WDEQ as supporting information in order to obtain approval for the proposed CBM discharge. WDEQ analyzes water pollution potential and establishes effluent limitations (currently under review by WDEQ), water quality standards and aquatic standards under its authority from EPA to administer the federal Clean Water Act (as amended). These WDEQ requirements represent the water characteristics that are necessary for continued safe consumption or use of water downstream by humans and other species.

After an NPDES permit is issued, the effluent (CBM produced water) and the receiving waters downstream from the discharge point are monitored regularly by the CBM operator as specified by WDEQ and other agencies).

Characteristics of Surface Waters

The flow regimes, temperature, turbidity, and water chemistry anticipated as a result of CBM development should be disclosed and analyzed in comparison with the aquatic habitat required by species already inhabiting receiving waters (rivers and tributaries) downstream of the discharge points. Changes in pH, TDS, and salts are critical to fish and aquatic life. Since the discharge water quality is variable, specific analysis must be done and included in this EIS in order to

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accurately assess impacts to fish and aquatic life. Field scientific study, using water discharge data and projected ecosystem changes needs to be done to accurately assess impacts.

Response:

Limited existing information is available for use in characterizing the perennial receiving waters, flow regimes, and anticipated stream erosion downstream of the discharge points or the proposed discharges of CBM produced water. Environmental conditions between a discharge point and the perennial waters downstream will vary according to soil type, geology, existing stream flows, and other factors. Natural variations in the character of the produced water also will occur.

Localized conditions in existing downstream perennial waters could change as mixing of different types of water occurs, if produced water discharged directly into a drainage having perennial flow. Localized conditions are unlikely to change where discharge into an ephemeral drainage occurs. It is unlikely that existing turbid perennial waters downstream of discharge points will clear up.

Additional surface water monitoring sites will be established in order to collect information related to surface water characteristics, flow regimes, substrates, and aquatic habitats. Parameters such as water temperature, turbidity, or chemistry, that could affect the suitability of downstream waters as habitat for various aquatic species will be measured at these surface water monitoring sites. Monitoring related to specific habitats (such as sturgeon chub) will be incorporated within monitoring plans where suitable existing habitat may be affected by CBM activities.

Surface Flows - CBM Produced Water

Vast quantities of water will be discharged during CBM development. Realistic estimates were not used in the EIS for the number of wells and the volume of water produced. There is no specific mitigation plan or compensation plan for landowners in the EIS.

Response:

Larger volumes of water are produced from CBM wells at the onset of production and shortly thereafter. Later in the life of a CBM well, water production declines. Flow averages over the life of a well are used in this analysis to provide an estimate of cumulative groundwater withdrawal and surface water discharge.

Flow rates, annual flow volumes, and maximum instantaneous flows are projected by CBM operators in applications for groundwater appropriation permits. These values typically are somewhat overestimated to ensure that an adequate groundwater right is filed with the WSEO. Well completion reports document the actual flow when a well is completed. Monthly production reports filed with the WOGCC document water production over time during the life of a well.

The estimate of water production used in this analysis (CBM produced water) was compared to WOGCC production statistics for May 1999 that covered 902 producing CBM wells within the

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Wyodak study area. Producing CBM wells averaged 12.4 gpm per well or produced water in May 1999. An earlier WOGCC analysis of 500 producing CBM wells showed an average water production per well of 14.6 gpm.

Even through water production may vary within the PRB and over time as wells continue production, it is necessary to take a hard look at cumulative groundwater withdrawals and cumulative surface water discharges. In order to analyze water volumes and water flows, these values must be estimated, even though they may be variable. The BLM has used the available data and its best professional judgement to make a representative estimate of water production for use in this NEPA analysis.

A specific mitigation plan or compensation plan for landowners is outside the authority of the BLM. The existing Water Well Agreement contained in Appendix D of the DEIS represents one such plan. It was developed by a working group of affected landowners and industry representatives (FEIS, p. 2-17).

Impoundments

Development of reservoirs on natural stream courses could severely impact native aquatic species and their habitats. Reservoirs should be sited in the uplands unless it can be shown that they will provide benefits to fish and wildlife resources.

Constructing larger (rather than smaller) ponds to retain produced water would provide more open water and a longer shoreline at one site. Larger ponds also may have the characteristics needed to support fisheries. Larger ponds may be more beneficial to wildlife.

Reservoirs or ponds created to retain the discharge of CBM produced water may create an attractive hazard to many species of birds and wildlife through the evaporative concentration of selenium. Water should not be stored in closed impoundments.

Response:

Impoundments on private land are considered and controlled by the surface owner, not the BLM. The BLM does recommend that water not be placed in playas or reservoirs that do not have properly designed flow-through structures. The BLM also recommends that main stem reservoirs not be used for water storage. WSEO authorizes surface water impoundments (reservoirs) based on engineering designs submitted by the applicant. Over 80 percent of the land area included in this analysis is privately owned. The impoundments on these lands are privately owned. The BLM has no authority relative to the future maintenance or reclamation of these structures.

Applicable Comment Letters (Wildlife/Fisheries):

1, 7, 8, 9a, 11, 15, 17, 18, 19, 25, 28, 33, 34, 40, 43, 44, 48

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have to be implemented under municipal or county land use plans in order to limit the disturbance of nearby residents or wildlife populations.

Alternatives - Beneficial Use

The alternatives for beneficial use of the CBM produced water should be analyzed in the EIS before a decision is made regarding the disposal of CBM produced water.

Response:

WSEO authorizes the proposed appropriation of groundwater from a CBM well, the beneficial use(s) of the appropriated groundwater, and the specific locations of use identified by the applicants (landowner and CBM operator) in a groundwater appropriation permit (U.W.5). A coal bed methane well is recognized by the agency as a beneficial use of groundwater in Wyoming. Other beneficial uses, such as stock watering or irrigation, when applicable, also are listed on the permit application. The alternatives for beneficial use of the CBM produced water are not analyzed by the WSEO. The groundwater appropriation permit documents the nature and priority of groundwater rights filed in Wyoming.

The specific location where the appropriated groundwater is discharged onto the land surface and the effluent (water discharge) are authorized by WDEQ in an NPDES permit. Alternative locations for CBM produced water discharge points are not analyzed by WDEQ. The WDEQ's analysis focuses on requirements for effluent limitations and discharge monitoring that provide for continued safe use or consumption of Wyoming surface waters.

Surface use plans, including water discharge points, for federal wells are reviewed by the BLM (and/or FS). The analysis of plans for federal wells involving private surface ownership is a collaborative effort among the agency, the landowner, and the CBM operator. As conservator of the federal surface and mineral estate, the BLM retains responsibility for ensuring that the federal mineral resource is conserved (not wasted), and is developed in a safe and an environmentally sound manner. However, the BLM does not control the appropriation or use of groundwater.

Livestock Grazing - Rest Rotation Practices

Grazing management plans that rely upon turning water on and off in different areas to move or disperse livestock and manage the utilization levels of available forage could be affected by the continued availability of CBM produced water throughout the year.

Response:

Impacts from the "new" perennial flows of CBM produced water on grazing rest-rotation practices will be analyzed site-specifically as APDs and plans of development for federal CBM wells are reviewed by the BLM. The potential mitigation of removing livestock from an area or fencing out livestock likely would be the only feasible ways of preserving the objectives of rest-rotation grazing

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systems, where the water could no longer be turned on or turned off at will. Where federal surface is involved, water management plans (and plans for water disposal) would have to meet the provisions established in AMPs (allotment management plans) or the AMP would have to be revised.

Land Surface Impacts and Reclamation

Soil and vegetation loss and noxious weed invasions are significant impacts of CBM development and should be addressed adequately in the EIS.

Reclamation standards, requirements, and goals should be described in detail in the EIS. The future maintenance and reclamation of impoundment structures (dams) also should be addressed. Only native species should be used in revegetation mixes.

Response:

Soil and vegetation loss and noxious weed invasions will be analyzed site-specifically as APDs and plans of development for federal CBM wells are reviewed by the BLM.

Reclamation standards, requirements, and goals, including any requirements to utilize native species for revegetation, will be analyzed site-specifically as APDs and plans of development for federal CBM wells are reviewed by the BLM.

Land Use Conflicts

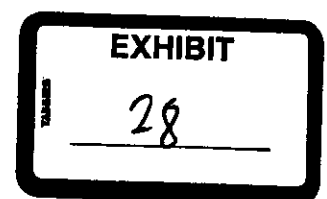
Conflicts between CBM development and other land uses should be addressed in the EIS. The BLM's decisions regarding CBM development on federal leases significantly affect private landowners. Other agency decisions regarding CBM development on fee and state leases also significantly affect private landowners.

Response:

Conflicts between CBM development and other land uses will be analyzed site-specifically as APDs and plans of development for federal CBM wells are reviewed by the BLM. The BLM's decisions regarding CBM development on federal leases do significantly affect private landowners. Other agency decisions regarding CBM development on fee and state leases also significantly affect private landowners. Landowners will be involved in (on-lease) decisions that affect their (off-lease) land. Water management plans are public documents and will be posted for public review upon receipt.

Stakeholder Involvement

Landowners should be involved in (on-lease) decisions that affect their (off-lease) land.



JOINT PUBLIC NOTICE

U.S. ARMY CORPS OF ENGINEERS
AND
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

PROPOSED GENERAL PERMIT 03-04

The District Engineer, Omaha District, U.S. Army Corps of Engineers, 106 South 15th Street, Omaha, Nebraska, 68102 is considering issuance of General Permit No. 200320004 (GP 03-04), pursuant to Section 404 of the Clean Water Act of 1972. GP 03-04 would authorize reservoirs and associated facilities located in waters of the United States that are constructed for the purpose of managing water produced during development of Coal Bed Natural Gas. GP 03-04 would be applicable within the Wyoming portion of a geographic area defined as the Powder River Basin (PRB) in the *Record of Decision (ROD) and Resource Management Plan Amendments for the Powder River Basin Oil and Gas Project* issued by the U.S. Bureau of Land Management (BLM), Wyoming State Office in April 2003.

Under the authority of Section 404, the Corps regulates the discharge of dredged and fill material in waters of the United States, including wetlands. GP 03-04 would be issued in accordance with the "Regulatory Programs of the Corps; Final Rule," as published in the *Federal Register*, Volume 51, Number 219, dated November 13, 1986. Section 323.2(h) of those regulations define general permits as Department of the Army authorizations that are issued on a nationwide or regional basis for a category or categories of activities when (1) those activities are substantially similar in nature and cause only minimal individual and cumulative environmental impacts; or (2) the general permit would result in avoiding unnecessary duplication of regulatory control exercised by another Federal, state, or local agency provided it has been determined that the environmental consequences of the action are individually and cumulatively minimal.

General permits issued to avoid unnecessary duplication of other federal regulatory programs, such as the Application for Permit to Drill (APD) program administered by the BLM, are defined in Part 325.5(c)(3) as programmatic permits. Part 325.2(e)(2) gives the District Engineer authority to issue regional general permits for specific geographic areas, such as the PRB, after compliance with other procedures of the regulation. The Corps evaluation will include application of guidelines promulgated by the Administrator, U.S. Environmental Protection Agency, under the authority of Section 404(b) of the Clean Water Act of 1972 (40 CFR Part 230). Specifically, the Corps will ensure compliance with Part 230.7 of the guidelines, which are applicable to issuance of general permits.

The PRB encompasses approximately 12,500 square miles in all or parts of Campbell, Converse, Johnson, and Sheridan Counties in northeastern Wyoming as shown in Figure 1 of the ROD. The PRB includes portions of the Bighorn River, Tongue River, Powder River, Belle Fourche River, Cheyenne River, and North Platte River watersheds. A copy of Figure 1 from the ROD is attached.

Authorization of reservoirs associated with gas production within the PRB in Wyoming is necessary because the BLM has estimated that 39,000 gas wells will be drilled in the PRB during a 10-year period beginning in 2003 and most drilling would occur during the first 8 years. Gas wells produce water as a by-product. The BLM has estimated that 356,276 acre-feet of water would be produced in 2004, 386,336 acre-feet would be produced at the peak of production in 2006, and that water production would taper off to 2,038 acre-feet in 2017. The average rate of water production during the next 5 years (2004-2008) has been estimated to be 365,556 acre-feet per year.

The BLM administers the federal minerals under 68 percent of the PRB. The ROD approves a water handling method with emphasis on construction of impoundments for both infiltration and containment. Containment reservoirs would be located in uplands outside of waters of the U.S. and would be utilized less than 5 percent. Infiltration reservoirs could be located in waters of the U.S. and would be utilized between 30 and 70 percent depending on the sub-watershed with an average of 53 percent for the PRB. Therefore, it may be necessary to utilize infiltration reservoirs to manage approximately 193,745 acre-feet of water per year for the next five years on average and 131,746 acre-feet of that amount would be managed under the BLM's jurisdiction.

Infiltration reservoirs may be created by rehabilitation and/or enlargement of existing dams, by construction of new dams, or by construction of dikes. A dam is defined as the placement of fill to impound water on a stream channel. A dike is defined as the placement of fill to contain water in areas adjacent to streams but dikes are located off-channel. Reservoirs located in waters of the U.S. in the PRB are primarily located on ephemeral streams due to the geography of the area as well as the desire to maximize the amount of storage provided. Reservoirs located on perennial streams would not satisfy the project purpose in most instances because natural runoff would fill the reservoir leaving little or no storage available for water produced by gas wells.

The Wyoming State Engineer's Office (WSEO) has determined that it may be necessary to construct channels around reservoirs to by-pass natural runoff in order to prevent mixing with water produced by gas wells as a means of satisfying downstream water rights. This requirement is actually a means of addressing water quality concerns in instances where the beneficial use is irrigation. The WSEO has indicated that by-pass channels should be designed to convey base flows up to the 50 percent chance exceedance (2-year return interval) flow event.

If issued, GP 03-04 would authorize specific activities in waters of the U.S. necessary for rehabilitation, construction, and operation of reservoirs when the project purpose is storage of water produced by gas wells. Activities that could be authorized by GP 03-04 are described in Appendix A of this notice. The proposed permit criteria in Appendix A are in draft form and are subject to change.

All authorized activities must be accomplished in compliance with general conditions as described in Appendix B. General conditions are necessary to ensure compliance with regulations and policies established pursuant to the goal of the Clean Water Act of 1972, which is "...to restore and maintain the chemical, physical, and biological integrity of the nation's waters." Protection of wetlands is important because wetlands provide a number of functions that are important to maintaining clean water; including, flood flow attenuation, sediment trapping, nutrient removal, groundwater recharge, and erosion protection.

Permittees would be required to obtain written verification from the Corps or the BLM that a proposed activity is authorized by GP 03-04 prior to undertaking the activity if more than 0.10 acre of waters of the U.S. would be filled due to a discharge of dredged or fill material. The BLM would have the authority to issue verifications for activities associated with federal mineral development without prior coordination with the Corps because the BLM conducts an evaluation of potential environmental consequences for each APD in accordance with requirements of the National Environmental Policy Act of 1969, Endangered Species Act of 1973, National Historic Preservation Act of 1966, Executive Order 11990 for the Protection of Wetlands, and other federal laws. The Corps would retain its authority to enforce compliance for all GP 03-04 authorizations, including those associated with federal mineral development. However, authorization by the Corps does not supersede the authority of other agencies to impose and enforce conditions that are more restrictive. The permittee would be required to comply with all other federal, state, tribal, and local requirements imposed by other agencies. The notification procedure for GP 03-04 is defined in Appendix C.

At this time, the Corps is soliciting comments from the public; federal, state and local agencies and officials; Indian tribes; and other interested parties in order to properly evaluate the potential environmental affects of activities that could be authorized by GP 03-04. Any comments received will be considered by the Corps in its decision whether to issue GP 03-04.

The decision will be based on an evaluation of potential effects, including cumulative effects, of authorized activities on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from authorized activities must be balanced against any reasonably foreseeable detriments. All factors which may be relevant to the decision will be considered; including, water quality, wetlands, historic properties, fish and wildlife, flood plains, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production, mineral needs, conservation, economics, aesthetics, considerations of property ownership and, in general, the needs and welfare of the public.

Comments are also used to determine the need for a formal public hearing. Any person may request, in writing and within the comment period specified in this notice, that a public hearing be held for the purpose of gathering relevant information that cannot be provided through other means. Requests for public hearings must be identified as such and shall state specifically the reasons for holding a public hearing.

Any interested party (particularly officials of any town, county, state, federal, Tribal, or local organization whose interests may be affected by activities authorized by GP 03-04) is invited to submit to this office written facts, arguments, or objections on or before the expiration date of this notice. Any agency, individual, or organization objecting to issuance of GP 03-04 should specifically identify it as an objection with clear and specific reasons. Comments, both favorable and unfavorable, will be accepted, made a part of the record and will receive full consideration.

The Wyoming Department of Environmental Quality (WDEQ) has authority to place additional terms and conditions on authorized activities under authority of Section 401 of the Clean Water Act of 1972. Section 401 gives the WDEQ authority to further regulate activities requiring a federal license or permit, such as a Section 404 permit, based on water quality standards. Section 404 permits, including general permits, cannot be issued without certification from the WDEQ that authorized activities will not violate applicable water quality standards. The WDEQ will also consider comments with an intent to certify in accordance with provisions of Section 401 and hereby incorporates this public notice as its own public notice.

If issued, GP 03-04 would be in effect for a period of five years from date of issuance. However, it would be subject to extension, modification, suspension, or revocation by the District Engineer in accordance with applicable regulations. The District Engineer retains discretionary authority to prohibit the use of general permits for specific activities and may require the submittal of an application for a standard permit if a particular activity would result in more than minimal impacts to the aquatic environment.

In compliance with the National Historic Preservation Act (NHPA) of 1966, the lead federal agency (Corps or BLM) will check the National Register of Historic Places and its current supplements and coordinate with the Wyoming State Historic Preservation Office (WSHPO) as required. In most cases, the Corps believes that authorized activities would have "no adverse effect" on historic properties. The Corps will consider comments concerning the procedure for protection of historic properties and cultural resources provided by the WSHPO and others in response to this public notice.

In compliance with the Endangered Species Act (ESA) of 1973, the lead federal agency (Corps or BLM) will evaluate proposed activities for potential adverse affects on threatened or endangered species and critical habitat. If it is determined that an activity may affect a species designated as threatened or endangered, or its critical habitat, the lead federal agency will consult with the U.S. Fish and Wildlife Service (USFWS). Activities cannot be authorized that are likely to jeopardize the continued existence of a federally listed threatened or endangered species or critical habitat. The Corps will also consider comments concerning protection of threatened or endangered species provided by the USFWS and others in response to this public notice.

All replies to this public notice must be sent to the Corps at the following address:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Mr. Thomas Johnson may be contacted for additional information at (307) 772-2300.

Comments received after the expiration date of this public notice will not be considered.

This and other public notices issued by the Wyoming Regulatory Office can also be obtained by visiting its web site at <http://www.nwo.usace.army.mil/html/od-rwy/Wyoming.htm>.

APPENDIX A AUTHORIZED ACTIVITIES

As currently proposed, GP 03-04 would authorize the following activities associated with storage and management of water produced during development of coal bed natural gas within the Powder River Basin:

1. **Surveys:** The purpose of these activities is to gather relevant geographic and scientific information about an area prior to development. Surveying activities include core sampling and other exploratory-type bore holes; soil survey and sampling; and historic resources surveys. Plugging of test holes may also be necessary. All disturbed areas in waters of the U.S. must be restored to original contours. The discharge of drilling mud and cuttings may require a separate permit under Section 402 of the Clean Water Act.
2. **Access Roads:** The purpose of this activity is to provide either temporary or permanent access to a reservoir location. Road crossings of waters of the U.S. must be culverted, bridged, or otherwise designed to allow passage of the 50 percent chance exceedance (2-year return interval) flood event. Crossings that are designed to function as fords are acceptable. The filled area for a single road crossing is limited to 0.25 acre of waters of the U.S., including wetlands.
3. **Outfall Structures:** The purpose of this activity is to discharge water into a reservoir. Outfall structures must be designed to prevent erosion at the point of discharge. The volume of fill for an outfall structure is limited to 25 cubic yards.
4. **Reservoirs:** The purpose of this activity is to impound water. Reservoirs are created by rehabilitation and/or enlargement of existing earthen dams or dikes; or by construction of new earthen dams or dikes. The filled area for dams and dikes in waters of the U.S. is limited to 0.50 acre. The area in waters of the U.S. inundated by a reservoir is limited to 1.0 acre, which includes areas excavated to increase storage capacity. Construction of reservoirs for containing petroleum products other than produced water is not authorized. However, produced water may contain minor amounts of petroleum products provided the reservoir complies with Wyoming Water Quality Rules and Regulations, Chapter 1, Section 29, concerning oil and grease accumulation.
5. **Erosion Control Structures:** The purpose of these activities is to prevent erosion of stream channels due to the discharge of water from reservoirs. Erosion control structures include revetments, stream barbs, and vanes to prevent erosion of stream banks. Grade control structures such as sills and weirs can be used to prevent erosion of stream beds. The volume of fill is limited to 1 cubic yard per linear foot for revetments and 50 cubic yards per structure for stream barbs, vanes, sills, and weirs.
6. **Flow By-Pass:** The purpose of this activity is to by-pass natural runoff around reservoirs to prevent mixing with produced water. The volume of fill for diversion and outfall structures necessary for operation of a by-pass channel is limited to 50 cubic yards. The area in waters of the U.S. affected by excavation of a by-pass channel is limited to 0.25 acre.

APPENDIX B SPECIAL CONDITIONS

1. **Notification:** Permittees undertaking activities necessary for development of non-federal minerals must notify the U.S. Army Corps of Engineers (Corps) with a Notice of Intent (NOI) in accordance with the procedure described in Appendix C. A NOI is required prior to initiating any activity that requires filling more than 0.10 acre of waters of the U.S. The permittee shall not undertake any such activities unless and until the Corps provides written verification that the activity is authorized by GP 03-04. The Corps may determine that a standard (individual) Department of the Army permit is required in accordance with 33 CFR 325.2(e)(2).

Permittees may obtain verification from the U.S. Bureau of Land Management (BLM) for activities associated with development of federal minerals without prior notification of the Corps. However, the notification requirement described above would apply if the BLM declines.

2. **Water Quality:** The permittee must comply with all terms and conditions of water quality certifications issued by the WDEQ under Section 401 of the Clean Water Act (see 33 CFR Part 330.4(c)).

3. **Best Management Practices:** Permittees are required to conduct authorized activities according to the following guidelines in order to avoid and minimize adverse effects on water quality and the aquatic environment.

- (a) Control the storage and disposal of petroleum products, chemicals, or other deleterious materials in such a way that it cannot enter waters of the U.S., including wetlands;
- (b) Control all construction debris, fill, and other materials disposed on upland in such a way that it cannot enter waters of the U.S., including wetlands;
- (c) Undertake all work in such a manner so as to limit increases in suspended solids and turbidity;
- (d) Limit the clearing of vegetation to that which is absolutely necessary for construction;
- (e) Maintain appropriate erosion and siltation controls in effective operating condition during construction, stabilize all exposed soil and any disturbed areas at the earliest practicable date; and
- (e) Advise downstream water users of any adverse water quality changes caused by construction.

4. **Suitable Fill Material:** No discharge may consist of unsuitable materials (e.g., trash, debris, car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts as required by Section 307 of the Clean Water Act.

5. **Stockpiling:** Storage of excess soil or unwanted vegetation in waters of the U.S., including wetlands, outside of approved areas is not authorized.

6. **Scrub-Shrub and Forested Wetlands:** No activity is authorized that would affect more than 0.10 acre of scrub-shrub and forested wetland combined as identified under the Cowardin classification system.

7. **Wetland Mitigation:** All projects must be designed to avoid wetlands and minimize adverse effects on wetlands that cannot be avoided. Wetlands that are temporarily filled (less than 90 days) must be restored. Restoration includes reestablishing natural ground contours and replacement of wetland soil in disturbed wetland areas. Activities that result in filling more than 0.25 acre of wetland must be designed to restore or create similar wetland (in-kind) elsewhere, preferably near the project area (on-site), at a minimum replacement ratio of 1:1. **This mitigation requirement does not supersede or prevent any other federal, state, or local agency with jurisdiction over the project from imposing additional mitigation measures.** Mitigation measures must be implemented concurrent with construction of the reservoir. If mitigation is unsuccessful, the permittee may be required to undertake additional mitigation measures as directed by the Corps and/or the BLM.

APPENDIX B

SPECIAL CONDITIONS (continued)

8. Historic Properties: No activity is authorized that would adversely affect sites included in the most current listing of the National Register of Historic Places or sites known to be eligible for such listing, sites included in the National Register of Natural Landmarks, or any other known historic, cultural, or archaeological sites.

9. Threatened and Endangered Species: No activity is authorized that is likely to jeopardize the continued existence of species, or critical habitats, designated or proposed for designation as threatened or endangered pursuant to the Endangered Species Act of 1973. Information on threatened and endangered species may be obtained from the U.S. Fish and Wildlife Service.

10. Wild and Scenic Rivers: No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless, the appropriate federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status.

11. Tribal Rights: No activity is authorized that would impair reserved Tribal rights; including, but not limited to, mineral, water, fishing, and hunting rights.

APPENDIX C NOTIFICATION PROCEDURE

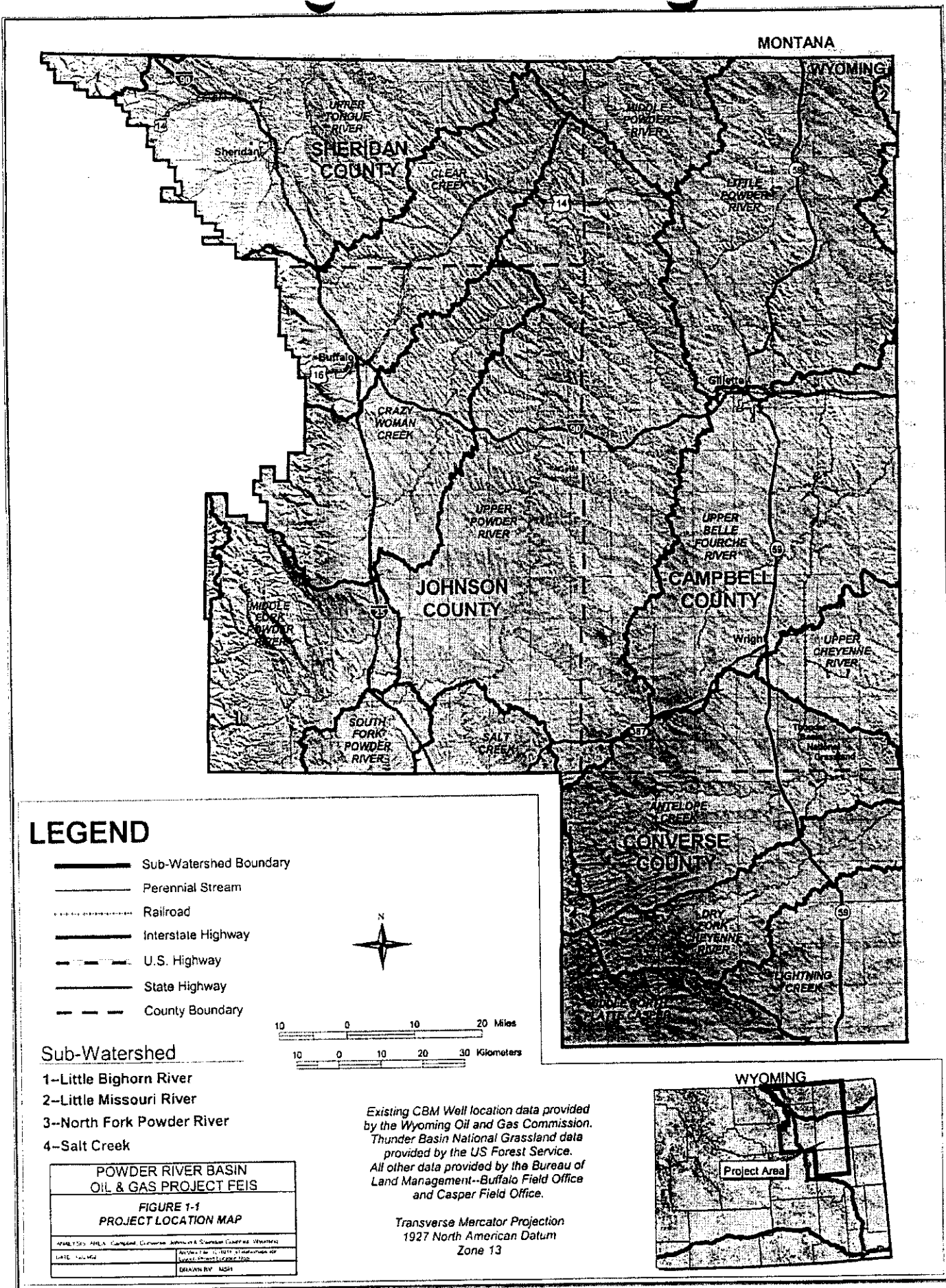
Permittees undertaking activities necessary for development of non-federal minerals must notify the U.S. Army Corps of Engineers (Corps) with a Notice of Intent (NOI) in accordance with this procedure prior to initiating any activity that requires filling more than 0.10 acre of waters of the U.S. The NOI must be in writing and must include project specific information as described in Items 1-6 below. The standard permit application form (Form ENG 4345) may be used for the notification, but must clearly indicate that it is a NOI for GP 03-04.

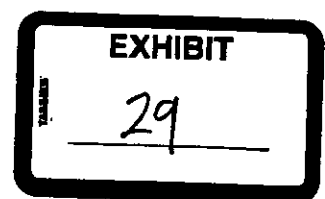
1. Name, mailing address, contact person, and telephone number(s) of the permittee.
2. Names, mailing addresses, and telephone number(s) of the property owner.
3. Copy of the appropriate portion of a U.S. Geological Survey map with the project location identified.
4. Brief project description with project drawings including the reservoir name, dam height, surface area, stream length and other relevant information for all authorized activities.
5. Wetland delineation for the entire reservoir area if wetlands are present or a determination that no wetlands exist at the site. Delineations must be prepared by a qualified individual in accordance with *Corps of Engineers, Wetland Delineation Manual* dated January 1987. Delineation reports must identify the location and size in acres of wetlands that are filled, excavated, or inundated for all authorized activities.
6. Mitigation plan for reservoirs that would require filling more than 0.25 acre of wetland for all authorized activities combined. The plan must include a complete description of soil and water manipulation techniques, revegetation techniques, plan view and cross-sectional drawings, and a map that shows the location of the mitigation area(s).
7. Photographs of the reservoir area and proposed mitigation area(s).

All NOI's for GP 03-04 must be sent to:

U.S. Army Corps of Engineers
Wyoming Regulatory Office
2232 Dell Range Boulevard, Suite 210
Cheyenne, Wyoming 82009-4942

Questions concerning this notification procedure should be directed to the Wyoming Regulatory Office at the above address or by telephone at (307) 772-2300.





FILED
U.S. DISTRICT COURT
DISTRICT OF WYOMING
JAN - 5 2004

Betty A. Griess, Clerk
Cheyenne

UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

vs.

U.S. ARMY CORPS OF ENGINEERS,

Respondent.

Case No. 02-CV-155-D

DECLARATION OF
BERNADETTE BARLOW IN
SUPPORT OF PETITIONERS'
MOTION FOR PRELIMINARY
INJUNCTION

I, Bernadette Barlow, do hereby declare as follows:

1. The facts set forth in this affidavit are based on my personal knowledge.

As to matters that reflect a matter of opinion, they reflect my personal opinion and best judgment on the matter.

2. I am a rancher in Gillette, Wyoming. I have owned and worked on my ranch for forty years. My deceased husband, William Barlow, was raised on this ranch. This ranch has been in our family for nearly eighty years. This ranch is very special to me.

3. I am a member of Wyoming Outdoor Council (WOC). WOC is an organization that advocates for natural resource conservation and environmental protection, and is the largest statewide conservation organization in Wyoming. WOC is a non-profit membership organization founded by Wyoming residents concerned about the conservation and preservation of Wyoming's unique environment. WOC encompasses a broad range of conservation issues such as public lands protection, state environmental policy, wildlife and its habitat, oil and gas development, and watersheds and rivers. WOC works to protect Wyoming's national parks and protected areas, vast national forests and other public lands as well as our magnificent wildlife and its habitat, blue

ribbon fisheries, and our excellent air and water quality. To this end, WOC mobilizes grassroots campaigns, organizes and leads coalitions of conservation groups, advocates public policies and pursues administrative remedies and legal interventions to deter environmental harm.

4. I am also a member and on the board of directors of the Powder River Basin Resource Council. The purpose of the Powder River Basin Resource Council is to keep Wyoming's lands sustainable for continued agricultural use. Powder River Basin Council educates citizens about the nature of development activities likely to affect our lands and seeks to hold developers accountable for the harms they cause. The Powder River Basin Resource Council is not opposed to mineral development. We are opposed to irresponsible and reckless oil and gas extraction. Powder River Basin Resource Council has been particularly active in ensuring coalbed methane (CBM) development is pursued in a responsible manner. We bring together landowners and citizens in Sheridan, Johnson and Campbell counties, who have experienced or anticipate unreasonable and unnecessary damages from CBM development, to educate them about their rights and help give them a voice against irresponsible and destructive oil and gas development.

5. My ranch is my home. It provided a wonderful place to raise our three children. Our whole lifestyle has been and will continue to be turned upside down by coalbed methane development. I think preserving the agricultural lifestyle so many of us enjoy in Wyoming is very important.

6. Oil and gas development harms our beautiful state. Wyoming is a unique place because it has such wonderful landscapes and natural, undeveloped areas. My ranch is home to wild animals, plants and other valuable natural resources. I love my home because of its clean air, clean water and the solitude it provides. Oil and gas development has harmed the environment of Wyoming. CBM development, now being permitted and facilitated by GP 98-08 (the subject of the above-captioned litigation), continues to harm our environment and my ranch.

7. I have seen what traditional oil development has done to our land. CBM development is continuing this woeful legacy. There has been oil development on my ranch for nearly fifty years. The wells were drilled and associated facilities, such as roads, power lines and utilities, were built. In time, these facilities would deteriorate due to poor design, construction and lack of maintenance. The oil companies had often got what they wanted and would then sell the field to less conscientious and grossly under-capitalized companies. This cycle of decline continues to the point of abandonment of facilities and wells that have been idle for over a decade. We continually pursue the correction of these failings with the regulatory agencies and the oil companies. It can take years to get these issues remedied and we must constantly be vigilant.

8. I believe that the same thing is happening with the development authorized by GP 98-08. Large companies have come in and invested heavily into infrastructure. This infrastructure will deteriorate. As the companies' costs begin to overtake their returns, they will sell to smaller companies as has occurred with the oil industry. Those small companies won't have the money to make repairs when pipes, roads and power lines fall apart and the reservoirs begin to deteriorate and fail.

9. Once companies finish extracting resources from their wells, the wells have to be plugged up for public safety. In my experience, it takes years to get the oil companies to plug up the wells. There are seventeen oil wells operating on my ranch. There are an additional five oil wells that have been left idle for many years. I must pursue the companies, Bureau of Land Management and Wyoming Oil and Gas Conservation Commission to ensure these wells are dealt with. It, unfortunately and unnecessarily, takes years to get these issues addressed and all the while, public safety and other resources, such as groundwater, are jeopardized.

10. The bonds required of oil and gas develops are grossly inadequate. They do not cover the costs of reclamation and restoration when the company fails to complete these obligations for the damages they cause.

11. I, and other members of the Powder River Basin Resource Council and Wyoming Outdoor Council, will be left with the damage resulting from GP 98-08. The unique and wonderful environment we have here in Wyoming will be damaged. Our clean water is being ruined, our wildlife's habitats are being destroyed and our enviable landscape is being degraded by industrial structures. Due to oil and gas development, Wyoming is not as pristine and beautiful as it once was; it continues to change for the worse due to activities authorized under GP 98-08. The quality of my home, my community and my state are declining with the widespread and careless CBM development being allowed by GP 98-08.

12. My ranch is approximately 18,000 acres of mixed grass rangeland. I own about three percent of the mineral rights. The rest are owned by the federal government, the State of Wyoming, or by private parties. The extraction of these minerals directly impacts my land. GP 98-08 authorizes oil and gas development activities, such as dredge and fill activities, which occur in waters of the United States, including pipeline crossings, road crossings, power line crossings and most importantly, the construction of in-channel reservoirs built for the purpose of holding CBM produced water.

13. I cannot demand that each company disclose or analyze the effects they will have on the surface land that I own from these authorized activities. I cannot even learn when or where such oil and gas activities have been authorized. Through GP 98-08, the U. S. Army Corps of Engineers (ACE) has already given them the right to proceed, without any notification to me or the ACE itself, in most cases. Similarly, I have no way of obtaining any information about proposed oil and gas activities, that come under GP 98-08, that are to occur on adjacent land, even though such activities will affect my land.

14. There are currently eight CBM wells on my land. Through my work with Powder River Basin Resource Council and Wyoming Outdoor Council, I have become aware of the harms caused to the land by CBM development. My friends, neighbors, and members of these organizations have suffered damage from the water pumped from CBM

wells and disposed of in their creeks. They have experienced flooding and increased salinity in their soil, causing the ruination of their crops and reducing the productivity and value of their farms and ranches. Methane gas bubbles up in water wells and in creeks as a result of the CBM development and extraction. This gas is dangerously flammable.

15. I know how damaging in-channel reservoirs can be. I have absolutely refused to allow reservoirs to be built in my creek. I have insisted that reservoirs on my property be placed off-channel.

16. However, there are numerous in-channel reservoirs constructed or modified for CBM development upstream of my ranch. Beginning in March of 2003 and ending in June of 2003, several of these reservoirs discharged water into the creek and that water flowed onto my property. Testing of this water revealed it was unsuitable to be utilized for irrigation. See Exh. 1. The results showed a sodium adsorption ratio (SAR) of 8.62 and an electrical conductivity (EC) of 3720. Id. These results certainly exceed the SAR of 6 and an EC of 2000 irrigation limits set by the Wyoming Department of Environmental Quality. The continual presence of this undesirable quality water inundated the creek channel on my property, including eight acres of land irrigated by permitted diversion. It also created salt deposits on the surface, turning the ground white and killing the desirable plant species. I am very concerned about the effects of the additional water from in-stream reservoirs that have been and may be built above my land.

17. GP 98-08 allows the construction of dams necessary for in-stream reservoirs. These reservoirs are not necessary for CBM production. There are numerous options available for the management of produced water. It can be re-injected into groundwater aquifers. It can be treated with ion exchange technologies and other treatment mechanisms so that the water will not harm crops and vegetation once it is discharged into the streams. They can and often do utilize off-channel containment structures, or use land application systems, where the runoff effects will not be as harmful.

18. Our creek bottoms have native grass. We rely on this native grass to feed our cattle year around. I don't want our native grass to be flooded by water flowing down the creek from in-channel reservoirs built for CBM water containment. GP 98-08 will allow more in-channel reservoirs to be constructed without the appropriate government oversight and the grass we rely upon will be submerged and killed by the overflow. Undesirable grasses and weeds can survive in CBM water, while the palatable native grasses cannot. My cattle will not utilize these invaders.

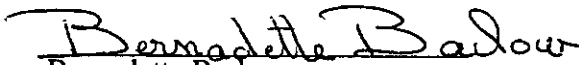
19. The continuous flow of water and elevation of the alluvial water table will impair the use of my land. Livestock and vehicular movement will be curtailed due to water and mud. The CBM produced waters will make operating my ranch much more difficult and costly.

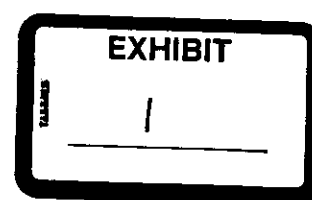
20. As a member of Wyoming Outdoor Council, a board member of Powder River Basin Resource Council, a long time rancher in Gillette and a concerned citizen of Wyoming, I believe the dredge and fill activities authorized by GP 98-08, particularly the construction of in-stream reservoirs, is ruining and will continue to ruin many things that I, and the organizations I belong to, hold dear. GP 98-08 will lead to significant impacts to my land, the aesthetics of our community, and our agricultural lifestyle.

21. Given the fact that the federal government has now approved the leasing of federal mineral rights for CBM development within the Power River Basin, applications for federal Applications for Permit to Drill are now being accepted by the U.S. Bureau of Land Management. I believe that the threat posed from in-channel activities, such as the construction of in-stream reservoirs, to be constructed in connection with these drilling permits, is imminent and immediate. Putting a stop to an "automatic" authorization to construct the reservoirs would greatly enhance my ability as a rancher and concerned citizen to monitor the permitting of these activities by the ACE, if ACE were to return to permitting such activities on an individual basis.

22. In my opinion, the many of the activities authorized by GP 98-08 have already resulted in significant damage to ranches that I have seen throughout the Powder River Basin. I have witnessed such damage, and experienced the same kind of damage on my ranch, and I believe that significant environmental harm, involving the destruction of native grasses and irrigated crops, will be visited upon my ranch unless steps are taken to rescind, suspend, or otherwise nullify GP 98-08 as a general permit authorizing dredge and fill activities within Wyoming.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on December 18, 2003, in Gillette, Wyoming.


Bernadette Barlow
1625 Buffalo Cut Across Rd
Gillette, WY 82718



1633 Terra Avenue
Sheridan, WY 82801**Quality Control Report**
Duplicate Analysis

Client: Barlow, Eric
Project: Dead Horse Creek
Sample ID: Nisseleus Fence
Lab ID: 0103W08615/0203W01259
Matrix: Water
Condition:

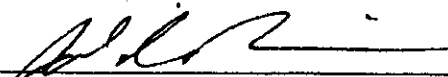
Report Date: 07/18/03
Receipt Date: 06/25/03
Sample Date: 05/22/03
Time Sampled: 1100

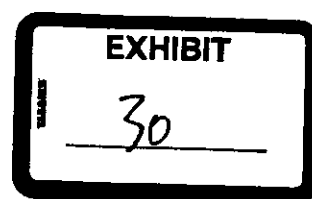
Parameter	Original Conc.	Duplicate Conc.	Relative % Diff.	PQL	Units
General Parameters					
Lab Conductivity @ 25°C	3,720	3,710	0	5	µmhos/cm
Sodium Adsorption Ratio	8.62	8.57	1	0.01	
Cations					
Calcium	195	190	3	1.0	mg/L
Magnesium	120	117	3	1.0	mg/L
Sodium	621	609	2	0.20	mg/L

These results only apply to the samples tested.

Reference: "Standard Methods For The Examination of Water and Wastewater", 19th ed., 1995.
EPA 600/R94/111, "Methods for the Determination of Metals in Environmental Samples-Supplement I", May 1994

Reviewed By:


Wade Nieuwsma, Water Lab Supervisor



FILED
U.S. DISTRICT COURT
DISTRICT OF WYOMING

JAN - 5 2004

Betty A. Griess, Clerk
Cheyenne

UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

VS.

U.S. ARMY CORPS OF ENGINEERS,

Respondent.

Case No. 02-CV-155-D

DECLARATION OF ED
SWARTZ IN SUPPORT OF
PETITIONERS' MOTION FOR
PRELIMINARY INJUNCTION

DECLARATION OF ED SWARTZ

1. My name is Ed Swartz. I am a full time rancher and the third generation to own and operate this ranch. My ranching operation is north of Gillette, Wyoming in the Powder River Basin. It is an arid area that receives on average about 14 inches of rain per year.
2. Wildcat Creek is an ephemeral drainage that runs through my ranch and has provided irrigation water to the adjoining meadows. I have excellent alfalfa and hay meadows along Wildcat creek and I harvest on average about 350 tons of hay per year from them. This hay base is integral to my ranching operation. The Wildcat Creek channel has also historically provided valuable forage.
3. Over the last few years dozens of dams have been constructed in Wildcat Creek and on the side channels to create reservoirs to hold discharge water pumped out of coalbed methane wells. The Wyoming State Engineer printout (attached) indicates there are currently 48 reservoir permit applications pending in the Wildcat Creek drainage, most of them on channel.
4. CBM water fills these reservoirs and then spills over and eventually the water reaches the creek running through my ranch. The water ran through my ranch for several months in the winter of 1999/2000 and winter of 2000/2001. CBM discharge flows resumed again this year in ~~mid-November~~ ^{late-October} and are expected to continue at least through April. ₂₀₀₁
5. After the water ran through my ranch for several months and then the water evaporated, the creek had white, crusty deposits left on it, a salt deposition, and all the vegetation was dead. The good grass that used to be in the creek is now being replaced by a sluzce grass that is not palatable for livestock or wildlife. (See attached pictures)
6. The Wyoming DEQ conducted a site visit and stated the following in their report: "Salt deposition in the channel of Wildcat Creek is extensive in many areas. Upwards of 75% of the channel through the Swartz Ranch has these extensive deposits. These areas most likely correspond to areas where channel water ponded. Evaporation concentrated the salts in these areas and subsequent drying of the sediments in the channel has brought leached salts back to the surface. Very little vegetation was observed in the channel bottom where extensive salt deposition has occurred. Ponded channel water sampled during the site visit has elevated pH values that exceed water quality standards and extremely elevated dissolved constituents that would make this water unsuitable for irrigation and livestock/wildlife watering." (report attached)

7. The mixing of poor quality CBM discharge water with rainfall and snowmelt has completely cut off my ability to use my water rights on the creek for traditional irrigation during a flood event. Historically I used the flood events to irrigate my hay meadows.
8. The in channel reservoirs above my ranch that are receiving CBM discharge water have significantly altered the creek in a negative way as it runs through my ranch.

I declare to the best of my knowledge the above statement is true and correct.

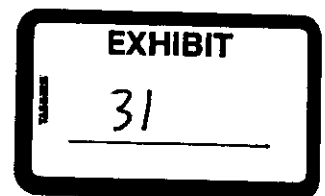
December 19, 2001
Date

Edward H. Swartz
Ed Swartz

P.O. Box 1539

Gillette, WY 82717-1539

Phone & FAX 307-682-9506



FILED
U.S. DISTRICT COURT
DISTRICT OF WYOMING

JAN - 5 2004

Betty A. Griess, Clerk
Cheyenne

UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

VS.

U.S. ARMY CORPS OF ENGINEERS,

Respondent.

Case No. 02-CV-155-D

DECLARATION OF JILL
MORRISON IN SUPPORT OF
PETITIONERS' MOTION FOR
PRELIMINARY INJUNCTION

I, Jill Morrison, do hereby declare as follows:

1. The facts set forth in this affidavit are based upon my personal knowledge. As to matters that reflect a matter of opinion they reflect my personal opinion and best judgment on the matter.

2. I am a member and community organizer for the Powder River Basin Resource Council. The Powder River Basin Resource Council was founded in 1973 by ranchers and citizens dedicated to working for the careful and responsible development of Wyoming's resources and to ensure the preservation of our agricultural heritage and rural lifestyle.

3. I began working with landowners in 1990 regarding new concerns over the impacts of a new type of gas development which involved extracting gas from coal seams by pumping out large volumes of water. The gas is referred to as coalbed methane or CBM.

4. I have worked with dozens of landowners over the last several years documenting and trying to address the impacts of CBM development. The biggest concerns of landowners involved the depletion of water wells and aquifers and the destruction of valuable grass and soil

that is caused by the dumping of CBM water into ephemeral streams and channels in the Powder River Basin.

5. I have been taking aerial photographs of CBM development on an annual to bi-annual basis since 2000. The aerial photographs attached to this declaration were taken by me of in-channel reservoirs built and expanded to contain coalbed methane water in the Dead Horse Creek drainage in Campbell County, Wyoming. Exhibit 1. I took these photographs from an airplane on May 12, 2003. We had received complaints from the Barlow ranch, the downstream landowners, regarding a large and unprecedented volume of water flowing down Dead Horse creek.


6. The photographs were also submitted to the Wyoming Department of Environmental Quality to investigate the discharge water. The DEQ confirmed in an on-site investigation in June of 2003 that the water flowing down Dead Horse creek was coming from the discharge of CBM wells into the in-channel pits which were all overflowing. Exhibit 2.

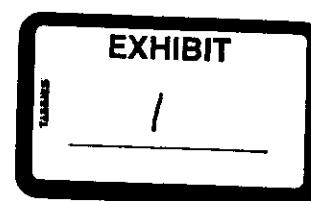
7. I have also observed the impacts to soil and water in the ephemeral streams on several ranches from CBM discharge water. The attached photos of Wildcat Creek on the Swartz ranch show how the continuous discharge of CBM water into inchannel reservoirs overflows and sends CBM water, which is higher in sodium than normal rainwater or snowmelt, downstream where it deposits salts in the streambed and the sodic water kills the native vegetation in the streambed and destroys the clay soils. Exhibit 3.

8. I have also observed native cottonwood and boxelder trees that have been killed by the continuous discharge of CBM water from in-channel reservoirs in the previously ephemeral streams. The discharge of CBM water to in-channel reservoirs is completely changing these ephemeral streams. The Army Corp of Engineers in their approval of the GP 98-08 permit for in-channel reservoirs never analyzed the extensive and long lasting impacts of the discharge of CBM water into ephemeral streams.

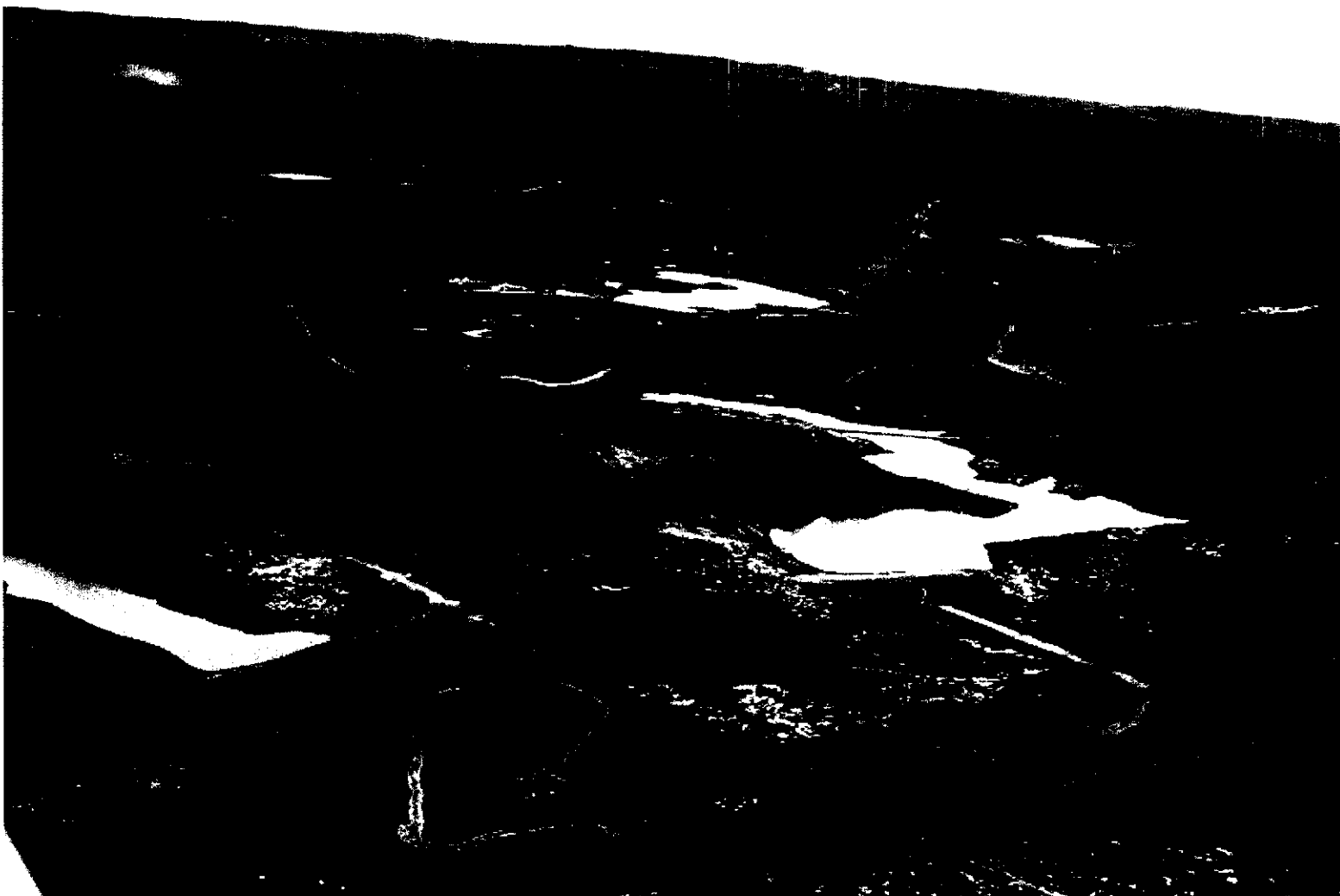
9. I have also observed and documented downstream subsurface flooding on private property caused by the discharge of CBM water into in-channel pits upstream. This was also not considered or analyzed by the COE in their approval of the GP 98-08 permit.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on January 2, 2004, in Sheridan, Wyoming.

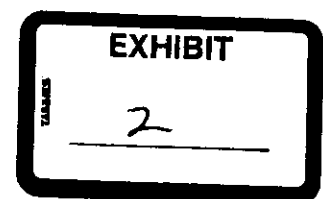

Jill Morrison
Sheridan, Wyoming













The State
of Wyoming



Department of Environmental Quality

1043 Coffeen Avenue, Suite D • Sheridan, Wyoming 82801

AIR QUALITY
(307) 672-6457
(307) 674-8050

LAND QUALITY
(307) 672-6488
Fax (307) 672-2213

WATER QUALITY
(307) 672-6457
Fax (307) 674-8050

MEMORANDUM

TO: Brian Bohlmann, NPDES Compliance Program Principal

FROM: Jim Eisenhauer, Compliance Inspector Senior Analyst

SUBJECT: Barlow Complaint: CBM Water Flowing Down Dead Horse Creek

DATE: August 11, 2003

On June 25, 2003, Department of Environmental Quality Inspector, Jim Eisenhauer, met with landowner Eric Barlow to observe produced Coal Bed Methane (CBM) water flowing down Dead Horse Creek. According to Mr. Barlow, water has been continuously flowing down Dead Horse Creek from approximately mid March through the month of June of 2003. The drainage of concern is South Fork Dead Horse Creek which has CBM discharges into reservoirs and off-channel pits within the drainage. The Barlows do not want any of the CBM water flowing onto their property and have been very active in the public comment process to ensure that the CBM water does not enter their property. According to Mr. Barlow, the flows have been fairly continuous since March with increases in flows from time to time. Mr. Barlow is concerned that some of the companies operating upstream may be letting water flow down drainage when the reservoirs fill up, instead of holding all of their water back. The Dead Horse Creek drainage on the Barlow Ranch was examined for flow, as well as the Dead Horse Creek drainage upstream of the Barlow Ranch where a few CBM operators have NPDES discharge permits within the Dead Horse Creek drainage, to determine the source of the water that is currently flowing in the channel.

The South Fork Dead Horse Creek channel was inspected at the southern most end of the Barlow's property in the NE 1/4 NE 1/4 of Section 27, Township 48 North, Range 75 West (Figure 1). Flow was observed in South Fork Dead Horse Creek and continued on down the drainage (Photo #1). The channel was not very defined at this location, and a variety of grasses were present in the area. The second location visited on South Fork Dead Horse Creek was in the NW 1/4 NW 1/4 of Section 22, Township 48 North, Range 75 West (Figure 1). An artesian well is present at this location which provides water for livestock in the area (Photo #2). Water flows into a stock tank at a very low flow rate, and the excess water is piped directly to the

stream. The discharge pipe from the stock tank was submerged under water in the channel (Photo #3). According to Mr. Barlow, under normal conditions, the pipe would not be submerged, and only a small amount of water would be present in the channel from the stock tank. It would appear that the excess water in the channel is coming from an upstream source, and not from the artesian well at this location. The final location visited was the confluence of South Fork Dead Horse Creek with Middle Fork Dead Horse Creek to form Dead Horse Creek near the Barlow's residence in the NE 1/4 SE 1/4 of Section 16, Township 48 North, Range 75 West. Water was present in South Fork Dead Horse Creek and in Dead Horse Creek, but not in Middle Fork Dead Horse Creek with the exception of some back wash from South Fork Dead Horse Creek at the confluence (Photos #4 and 5). The Middle Fork Dead Horse Creek drainage is approximately the same size as the South fork Dead Horse Creek drainage, but it does not have any, or very little CBM development on it. Therefore, the fact that South Fork Dead Horse Creek has had water flowing in it continuously from mid March through June, and Middle Fork Dead Horse Creek has not had continuous flows except during runoff events, indicates that the source of the flows in South Fork Dead Horse Creek are probably due to other sources than simply runoff and thunderstorm events. Therefore, some of the upstream CBM operators will need to be checked in order to determine if CBM water is being discharged down drainage and resulting in the flows that are reaching the Barlow's property.

On June 25, 2003 at approximately 1411 hours, DEQ inspector Jim Eisenhower met with Tony Wylie of Yates Petroleum, to observe their CBM discharge points within the South Fork Dead Horse Creek drainage. Yates Petroleum is the first upstream operator within the drainage that has discharges into South Fork Dead Horse Creek. The first permit that was inspected was NPDES permit number WY0037842. This permit was originally issued on November 1, 1998 and contained six outfalls. The permit was then modified on December 6, 2001 and had three of the original six outfalls removed from the permit. Currently outfalls 004, 005, and 006 remain on the permit, and this permit does not restrict the company from discharging into the Dead Horse Creek drainage, even though the company had committed to the total containment of the water in their Permit Modification Application dated November 19, 2001. The modified permit does not restrict the company from discharging into the drainage at any time of the year. Therefore, any discharges under this permit could travel down the Dead Horse Creek drainage, and the company would not be in violation of their permit.

According to Tony Wylie, the wells that discharge under this permit had been shut in for approximately a year to a year and a half due to low gas prices. The wells were turned back on sometime in March, and have continued to discharge. Mr. Wylie stated that the reservoirs would normally have the capacity to hold the water, but the extremely wet spring has caused the reservoirs to fill up with CBM water mixed with runoff water to the point that two reservoirs are overflowing and spilling water out from their outlet works into South Fork Dead Horse Creek. The first outfall that was visited during the inspection was outfall WY0037842-004 which discharges directly into an on-channel reservoir located in the SE 1/4 NW 1/4 of Section 36, Township 48 North, Range 75 West (Figure 1). A discharge was occurring from this facility at the time of the inspection and the water in the reservoir was spilling over into the drainage via a metal corrugated pipe placed at the high water level in the reservoir (Photos #1 and 2). However, water was also observed flowing in the drainage upstream of the outlet works from the

reservoir (Photo #3). Approximately 1/2 mile upstream of the reservoir which receives discharge water from outfall WY0037842-004 was an abandoned reservoir which no longer receives CBM discharge water under this permit. This reservoir is located in the SE 1/4 SW 1/4 of Section 36, Township 48 North, Range 75 West, and no CBM produced water was observed entering the reservoir or leaving the reservoir via its outlet works (Photo #4). Although the area immediately below the reservoir was damp and it appeared that water may have flowed down the adjacent hill side, no water was observed flowing from the reservoir. The source of the water upstream of the outlet works from the reservoir receiving CBM discharge water from outfall WY0037842-004 may have been from a recent thunderstorm event, but it does not appear to be the result of CBM discharge water.

Outfall WY0037842-005 located in the NE 1/4 NE 1/4 of Section 35, Township 48 North, Range 75 West was visited next, but no water was discharging from this outfall into the drainage (Figure 1). Therefore, this outfall was not contributing to the flows in South Fork Dead Horse Creek (Photo #5).

The final outfall visited under this permit was outfall WY0037842-006 located in the NW 1/4 NW 1/4 of Section 36, Township 48 North, Range 75 West (Figure 1). Water was discharging from this outfall into the reservoir which is located downstream of the reservoir which receives CBM discharge water from outfall WY0037842-004 (Photo #6). Therefore, this reservoir is currently receiving flows from outfalls 004 and 006. Water was discharging from this reservoir via its outlet works into the South Fork Dead Horse Creek drainage (Photos #7 and 8). This is the last discharge point upstream of the Barlow's property and it appears that this permit is the source of the water that is flowing down South Fork Dead Horse Creek. However, according to the permit conditions, the permit does not restrict the company from discharging into the drainage at any time during the year. Therefore, the company does not appear to be in violation of their permit conditions.

Finally, two off-channel reservoirs which receive CBM discharge water from outfalls permitted under NPDES permit number WY0047252 were inspected to make sure that water was not leaking from the reservoirs into the nearby drainage. The first off-channel reservoir inspected was receiving CBM discharge water from outfall WY0047252-007 at the time of the inspection. This reservoir is located in the NE 1/4 SE 1/4 of Section 36, Township 48 North, Range 75 West. The berm surrounding the reservoir as well as the surrounding area was inspected, and no reservoir breaches or seeps were observed from the reservoir. The reservoir is located a considerable distance to the northeast of the South Prong Dead Horse Creek drainage, which reduces the chances of water reaching the channel via the subsurface. The off-channel reservoir which receives CBM discharge water from outfall WY0047252-006 was also visited and this outfall is located in the SE 1/4 NE 1/4 of Section 36, Township 48 North, Range 75W above an unnamed drainage to South Fork Dead Horse Creek. However, no water was being discharged into the reservoir and the reservoir itself was completely empty and in the process of being worked on. Therefore, this outfall is not contributing to any flows in Dead Horse Creek. Outfall 008 was not visited because this outfall has not been constructed at this time. The inspector also visited a reservoir owned by Coleman Oil and Gas Inc. which receives CBM discharge water from outfall WY0041459-004. This reservoir is an on-channel reservoir located in the SW 1/4

SE 1/4 of Section 31, Township 48 North, Range 74 West (Figure 1). The level of the water in this reservoir was well below the outlet works from the reservoir at the time of the inspection, and was not contributing to the flows in South Fork Dead Horse Creek (Photo #9). This reservoir is located approximately one mile upstream of outfall WY0037842-004 on the same drainage and could contribute to the flows in South Fork Dead Horse Creek if overflows ever occurred.

Based on observations made during the inspection, water is discharging from two reservoirs operated by Yates Petroleum under NPDES permit number WY0037842. The discharges from these reservoirs are resulting in flows in the South Fork Dead Horse Creek drainage and these flows are entering the property owned by the Barlows approximately one to two stream miles to the northwest. However, the permit that is contributing to the flows in South Fork Dead Horse Creek does not restrict the company from discharging into the channel at any time during the year. Therefore, the company is not in violation of their NPDES permit. However, the permit is due to expire at midnight on October 31, 2003, and there is the possibility that more restrictive conditions may be incorporated into the permit due to downstream landowner's concerns about water flowing down Dead Horse Creek. Therefore, the company may want to consider other options for managing the water in order to keep the water from flowing downstream.

Also, There were some problems observed at the outfalls visited during the inspection that are not in compliance with the conditions specified in the permit. There were no NPDES permit signs present at any of the outfalls visited under NPDES permit numbers WY0037842 and WY0047252 owned and operated by Yates Petroleum. All outfalls need to be identified by an all weather permit sign which conveys the following information: company name, facility name, NPDES permit number, outfall number, legal description, and an emergency contact number. The discharge pipes at outfalls WY0037842-004 and 006 were completely submerged under water and not accessible for sampling purposes. These outfalls need to be brought back to the surface and placed at a location that is above the high water level of the reservoir. The outfalls should also be constructed in such a way that all of the flow leaves the pipe at a single point and a sufficient free fall to the surface should exist for an accurate flow measurement using a calibrated bucket. The free fall will also aid the sampler during sample collection so that a clean, representative grab sample can be collected. The company should apply these conditions to all of their outfalls so that the outfalls can be appropriately identified in the field and accurate flow measurements and clean grab samples can be collected.

SUMMARY:

- 1.) Eric Barlow has voiced concerns about the continuous flow of water down Dead Horse Creek from March through June of 2003. According to Mr. Barlow, the flows have been continuous throughout the specified time period with increases in flows from time to time. Mr. Barlow has been very active in making sure that no CBM water enters their property and is concerned about the recent increase in flows down South Fork Dead Horse Creek.
- 2.) The Barlow Ranch was visited on June 25, 2003 and water was observed flowing down

South Fork Dead Horse Creek. Although a small flow from an artesian well was contributing to the flow, the vast majority of the flow was coming from sources upstream of the Barlow Ranch.

- 3.) No flow was occurring in Middle Fork Dead Horse Creek which has very little if any CBM development within its drainage boundaries. However, South Fork Dead Horse Creek has a substantial amount of CBM development within its drainage, although most of the NPDES permits are for off Channel pits which require full containment of the water. However, there are a few option 2 permits that do allow for direct discharge into the drainage under certain conditions.
- 4.) NPDES permit number WY0037842 owned by Yates Petroleum allows for direct discharge into the drainage at any time of the year. This is the first permit that discharges into South Fork Dead Horse Creek upstream of the Barlow Ranch. Wells that operate under this permit had been shut in for approximately a year to a year and a half due to low gas prices. These wells were turned back on around mid March of 2003 which is approximately when flows were first observed by the Barlows on their ranch property.
- 5.) Water was observed leaving two of the reservoirs which receive CBM discharge water from outfalls 004 and 006 under NPDES permit number WY0037842. The water was observed leaving the reservoirs and flowing down South Fork Dead Horse Creek. Although the company has stated in their most recent permit modification application for NPDES permit number WY0037842 that they are committed to the full containment of the water being discharged, there is nothing in the permit that restricts the company from discharging into the drainage at any time during the year.
- 6.) However, NPDES permit number WY0037842 is due to expire at midnight on October 31, 2003, and more stringent permit conditions could be incorporated into the renewed permit. Therefore, the company may want to consider some alternative water management plans in order to prevent excess water from flowing down drainage.
- 7.) Some off-channel pits operated by Yates Petroleum under NPDES permit number WY0047252 were inspected and no reservoir breaches or seeps into the drainage were observed. Also, one on-channel reservoir owned and operated by Coleman Oil and Gas Inc. was observed, but the level of water in the reservoir was well below the outlet works from the reservoir. Outfall 004 under NPDES permit number WY0041459 is the outfall that discharges into this reservoir.
- 8.) Finally, some noncompliance issues were observed during the inspection at outfalls owned and operated by Yates Petroleum. None of the outfalls visited under any permit were identified with an all weather NPDES permit sign. These signs need to be placed in a visible location and convey the following information: The name of the company, the name of the facility, the NPDES permit number, the outfall number, the legal description for the outfall, and an emergency contact number. Also, several of the outfalls were either submerged under the water or buried under the soil which makes collecting a

5

representative grab sample and an accurate flow measurement nearly impossible. These outfalls need to be brought back to the surface and placed above the high water line so that the outfalls are easily accessible for sampling purposes. The outfalls should be provided with a sufficient free fall to the surface and the flow should be channeled to a single point so that a clean representative grab sample can be collected and an accurate flow measurement can be determined using a calibrated bucket.

James B. Eisenbauer / August 12, 2003

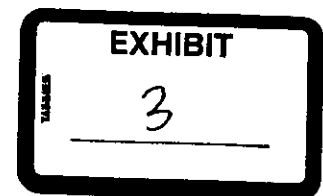
Signature Date

Senior Analyst

Title

References

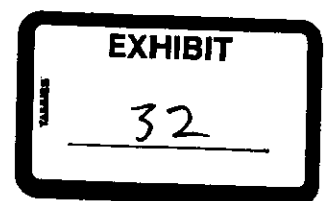
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U.S. DISTRICT COURT
DISTRICT OF WYOMING
JAN - 5 2004

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UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

VS.

U.S. ARMY CORPS OF ENGINEERS,

Respondent.

Case No. 02-CV-155-D

DECLARATION OF ERIK
MOLVAR IN SUPPORT OF
PETITIONERS' MOTION FOR
PRELIMINARY INJUNCTION

I, Erik Molvar, do hereby declare as follows:

1. I have personal first hand knowledge of the facts stated in this declaration and, if called to testify as to the truth of these facts, could and would do so.
2. I presently live in Laramie, Wyoming at 1008 South Fifth Street. I am an author of several guidebooks, including *Wild Wyoming* and *Hiking Wyoming's Cloud Peak Wilderness*, covering lands that contain countless wetlands and watercourses. I also am a professional photographer and have widely-distributed photographs of Wyoming lands, some of which have been published in my books, including lands with natural waterways, wetlands and native fish and wildlife.
3. I am Vice President and wildlife biologist for Petitioner Biodiversity Conservation Alliance (BCA). I have been a member of this organization since 1999. The goals of BCA are to secure the protection, restoration, and conservation of native wildlife and plants, as well as natural areas and habitats on public lands, in Wyoming and adjacent states. BCA was founded because citizens throughout the country were gravely concerned about the decline and loss of native plants and wildlife species in Wyoming and adjacent states. BCA's program for Wyoming's waters emphasizes protection of aquatic life -- native fish, amphibians, riparian plants -- and for the waters and wetlands they inhabit.

4. I have visited many of the areas, waters, and draws in Wyoming where GP 98-08 applies and projects have been or may be developed. These areas include Adobe Town, the Jack Morrow Hills, Wild Cow Creek, Hanna Draw and the lower Medicine Bow River, Bobcat Draw, Red Butte, McCullough Peaks, the Salt River Range, Commissary Ridge, the Mt. Leidy Highlands, the Roaring Fork of the Little Snake watershed, Fortification Creek, Rock Creeks (both in the Big Horns and in the Medicine Bows), the Miller Hills, the Little Powder River valley, the Dry Fork and Little Bighorn Rivers, the North Fork of the Powder River drainage, and the Tongue River. Several of these areas are within the Powder River Basin. In these areas, I hike, camp and fish for recreation, experience the natural aquatic ecosystems, view and photograph undisturbed landscapes as well as the native aquatic and terrestrial wildlife including birds, fish, and wetland plants, study the natural systems and species, and write guides so that other members of the public may also enjoy these outstanding attributes of our public lands. I intend to return to these places and take part in these activities in the future as long as these places remain intact.

5. In addition, because sales of my guidebooks and photographs are linked directly to the outstanding natural qualities of the lands covered in the books, and because royalties make up a significant portion of my annual income, degradation of waterways and surrounding lands would have a negative impact on my personal livelihood and that of my family. One recent example of this is a photograph I took of a prairie dog town. Coalbed methane development was actually built right over this town, with well pads and roads covering the prairie dogs' homes. The visual quality of my photograph was impaired by the fact that I captured an image of the prairie dog living in roads, rather than their natural habitat.

6. To achieve BCA's goals, I perform reviews of the scientific literature, conduct public education and outreach, and participate in administrative and legal processes. I helped prepare and edit a forthcoming report on Wyoming's native fishes, titled *Losing Our Aquatic Heritage: The Precarious Status of Native Fish in Wyoming*. I have also given numerous slide shows about the status of and need to protect and restore Wyoming's natural areas and waters,

and native aquatic wildlife and plants, to audiences in Laramie, Lander, Jackson, Casper, Baggs, Cody, Saratoga, Rawlins, Encampment, Riverton, Buffalo, Dubois, and Sheridan, Wyoming.

7. In addition, BCA has submitted comments and presented testimony addressing the need to protect and restore Wyoming's waters, wetlands and aquatic life to the United States Army Corps of Engineers, U.S. Forest Service, Wyoming Game and Fish Department, Wyoming Department of Environmental Quality and Environmental Quality Council, and U.S. Bureau of Land Management, including comments on the Corps' General Permit 98-08 found in the administrative record in Volume 1, page 341, dated May 14, 1999. BCA objected to GP 98-08 in these written comments due to the impacts on public lands, water, and native aquatic wildlife and plants that Biodiversity Conservation Alliance studies and works to protect. However, we were unable to thoroughly comment on the proposed GP 98-08, its impacts and potential alternatives because the Corps did not prepare and circulate a draft environmental analysis under the National Environmental Policy Act.

8. I have worked hundreds of hours to determine the biological status of native wildlife, including aquatic animals, plants and ecosystems in Wyoming, and to secure the protection and/or restoration of these vital components of Wyoming's natural heritage. I and BCA are nearing the completion of a biological report analyzing the conservation status of all of Wyoming's native fish, including fish within the Powder River Basin.

9. Activities authorized under GP 98-08 pose a significant threat to Wyoming's native fish, as well as endangered fish species downstream in the Upper Colorado River system. Specifically, unlined reservoirs and direct outfalls may allow highly saline and toxic wastewaters to enter groundwaters and/or surface streams, resulting in the direct mortality of fishes and aquatic insects. Furthermore, discharges of coalbed methane wastewater that enter waterways could fundamentally change the chemistry, turbidity, and timing of flows and temperatures in ways that interfere with the migration patterns of fishes, disrupt spawning cycles, and give competitive advantage to non-native invasive species, resulting in the local extirpation of native species even in cases where direct mortality does not occur.

10. I have observed numerous impacts of oil and gas activities on aquatic ecosystems throughout Wyoming. For example, I have made repeated visits to the Double Eagle Petroleum Cow Creek Pod of coalbed methane exploratory wells, during which I documented repeated releases of coalbed methane wastewater into an intermittent stream channel from an in-channel reservoir that was designed to contain 100% of the produced wastewater except in a 25-year flood event. In this case, wastewater heavily laden with salts was discharging from a pipe at the base of the dam during visits in May, June, September, and October of 2003, and a visible buildup of alkaline salts was occurring in the stream channel. These salts, and the heavy metals contained with them, will ultimately wash into the Muddy Creek during rainfall events.

11. The use of reservoirs to dispose coalbed methane wastewater is decreasing the breadth of my field of study and resulting in significant harm on one of Wyoming's greatest assets. In the Powder River Basin, the Forest Service and BLM routinely allows coalbed methane wastewater to be discharged directly into draws and stream channels, without regard for the health of aquatic ecosystems downstream. Retention and evaporation reservoirs, permitted under GP 98-08, are being constructed in the Powder River Basin without any lining to prevent seepage of toxic wastewater into groundwater aquifers or nearby surface channels. Further, in the Powder River Basin and other areas where coalbed methane development is occurring, large volumes of produced waters containing high concentrations of saline and alkaline are being dumped in the reservoirs authorized under GP 98-08. The disposal of produced waters (as well as road crossings, well pads and pipelines) are fundamentally changing Wyoming's waterways, especially in the Powder River Basin, making them uninhabitable to fish and wildlife.

12. I am concerned that GP 98-08 is and will continue to impact fish populations in Wyoming, and especially within the Powder River Basin, where thousand of new coalbed methane wells of planned. The Powder River is extremely special because it contains an intact native fish community, including several now-rare or declining species. There are 32 fish species in the Powder River and 25 of those species are native. Of the native fish species in the Powder River, the Sturgeon Chub is globally imperiled and the Western Silvery Minnow is in

drastic decline. The Shovelnose sturgeon, Goldeye, Sauger and Burbot are also rare and of conservation concern. The native fish community can remain intact if the river is relatively undisturbed by water development and channelization and if the existing flows, turbidity and water quality remain primarily natural.

13. Along the Atlantic Rim in south-central Wyoming, 3,880 coalbed methane wells have been proposed by the BLM and dozens have already been built. The majority of the project area falls within the Muddy Creek watershed, home to the flannelmouth sucker, bluehead sucker, and roundtail chub, all of which are rare and declining and are on the BLM Sensitive Species list. Furthermore, Muddy Creek drains directly into the Little Snake River, which has records of Endangered fishes including the Colorado pikeminnow, the largest member of the minnow family sometimes attaining sizes in excess of 60 pounds. According to reports from the U.S. Fish and Wildlife Service, the flows of the Little Snake River are critical to maintaining the appropriate turbidity levels and flow patterns of the Yampa River, home to all four of the Colorado River endangered fishes (bonytail, humpback chub, Colorado pikeminnow, and razorback sucker). The disposal of produced waters into reservoirs and the construction of dams, under the authority of GP 9808, will harm these declining native-fish populations.

14. The disposal of CBM waters into permitted reservoirs could radically change water flows on perennial and ephemeral waters. The disposal of produced waters swamps out creeks and rivers. Native fish species will not remain intact with these changes in water flow and quality. Spawning patterns of warm water fish are disrupted by changes in flow pattern resulting from the disposal of produced water. The spawning cues for warm water fish are based on water flows. Rather than the periodicity of flow, which warm water fish rely on for their cues, the water may flow at a steady state due to the presence of dams and reservoirs. Higher than normal water flow also increases sedimentation, which can have dire effects on native trout populations. Trout species lay their eggs in gravel and then cover the eggs up with the gravel. With increased sedimentation, these eggs would be smothered by silt and sand. Trout species may not endure under these changed conditions. Similarly, dams permitted by GP 98-08 also lead to massive

water changes, negatively impacting native fish. Water flows, water quality, water composition and temperatures downstream of dams are detrimentally changed.

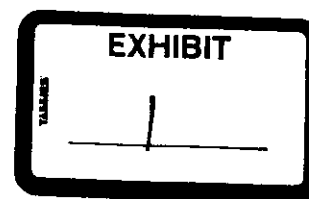
15. I have read with substantial concern articles in national and regional newspapers linking West Nile virus with numerous confirmed deaths of sage grouse in the Powder River Basin. See Exh. 1-3. The reservoirs built to retain coalbed methane wastewater often provide ideal habitat for mosquito larvae; adult mosquitoes are the direct vectors of West Nile Virus that are needed to transmit the disease to both humans and sage grouse. I have reviewed information from the Corps of Engineers own website which indicates that the mosquitoes that transmit West Nile virus are more likely to breed in pools of standing water, like newly created coalbed methane reservoirs, than well-established wetlands that contain a full complement of the mosquito larva's natural predators. Thus, in my professional opinion as a published ecologist, the radical increase in standing water as a result of the construction of thousands of coalbed methane wastewater ponds at a time of year (August) when West Nile outbreaks peak and standing water would ordinarily be scarce and restricted to a few larger stream channels, radically increases the opportunity for West Nile virus transmission to sage grouse versus pre-CBM conditions.

16. My scientific, conservation and recreational interest in Wyoming's waters and wetlands, and native species are impaired by activities permitted under GP 98-08. I have been harmed, and will continue to be harmed, because I will no longer be able to enjoy the activities I describe above. I believe that the quality of life I enjoy in Wyoming is being threatened by GP 98-08 and that I will be harmed by the changes I am seeing resulting from the activities this permit allows. I moved to Wyoming because I value the Clean Air, fishing and other outdoor opportunities, and wild and undeveloped places. As a result of oil and gas development activities in Wyoming generally and, in particular, those activities permitted by GP 98-08, I am witnessing widespread degradation of landscape, fragmentation of habitats, road sprawl and the conversion of wild areas into industrial areas. I am greatly harmed by these negative changes to

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on December 2, 2003, in Laramie, Wyoming.

A handwritten signature in black ink, appearing to read 'Erik Molvar', written over a horizontal line.

Erik Molvar



The New York Times

October 28, 2003,

Wyoming Checks Mines for West Nile Source

By JIM ROBBINS

An outbreak of West Nile virus in northeastern Wyoming has scientists and some residents wondering if an unconventional approach to natural gas extraction is increasing the risk of the disease.

The treeless prairie of the Powder River Basin in northeastern Wyoming is dotted with thousands of wells for extracting methane, which like other types of natural gas is used to heat homes.

But in these wells, unlike traditional ones, the natural gas is mixed with ground water. Every well that pumps out methane also pumps out ground water round the clock, and the arid region is dotted with hundreds of new ponds to hold the excess water.

In all parts of the country, health officials have advised residents that one of the first lines of defense against the mosquito-borne virus is to get rid of standing water. While the link between the methane wells and the virus is still under study, some scientists suspect that the standing water may be a rich breeding ground.

Joseph Icenogle, a spokesman for the Fidelity Exploration & Production Company, an oil and natural gas producer, said that the industry was aware of a possible link between West Nile and the ponds and that Fidelity was contributing to research about the deaths of sage grouse in the region. But to draw a link now, Mr. Icenogle said, would be "unscientific and very premature."

Since it appeared in New York in 1999, West Nile has quickly spread across the country. Last year, Wyoming had two confirmed human cases of West Nile virus; this year the disease was diagnosed in 356 people, and 8 of them died.

Although many cases of the infection are mild, there are risks of serious and potentially fatal complications. The severe form of the disease is characterized by swelling of tissues surrounding the brain, known as encephalitis.

Campbell County, which has the state's greatest concentration of the methane wells drilled into coal beds, had the second-largest number of West Nile cases, 61, according to state figures. Goshen and Platte ranked first and third, and each has an extensive flood-irrigation system that involves pooled water.

While the virus usually lives in birds, it also spreads from birds to mosquitoes to people and horses and other animals.

The death rate of birds is also running high in Campbell County. Brett Walker, a doctoral student tracking sage grouse with radio collars he had put on them, was searching last July for one of the birds in the sagebrush-studded plains near Spotted Horse, Wyo., a few miles north of Gillette.

"We finally got a beep," he said. When he found the bird, he added: "Its head was flopped over to the side. Fifteen minutes later, it was dead." Of the 15 birds that Mr. Walker had collared, 13 were found "face down in the dirt," he said. The birds had no marks from predators. He shipped

the dead birds to the a state laboratory for necropsy; state veterinarians found the birds had died of West Nile.

But among Mr. Walker's other collared grouse—two groups similar in size 30 miles away and outside the methane field region—none died from West Nile. Deaths of grouse from West Nile have also occurred in regions that do not produce methane, among them Alberta and northern Montana, but at much lower levels. Many other birds have also been affected by the virus, including golden eagles, magpies and pheasants.

Wyoming wildlife officials canceled sage grouse hunting season in September in Campbell and two other adjacent methane-producing counties to protect the remaining populations, which are already low. Experts say there is no danger to humans from eating a diseased bird, so long as it is thoroughly cooked.

Sage grouse are known for their elaborate courtship ritual. Each summer anywhere from a few to more than a hundred male sage grouse gather on a breeding ground, to strut and display before females that gather to scout out a breeder.

Their numbers have already been reduced by 80 percent to 90 percent, said Dr. David Naugle, an assistant professor of wildlife biology at the University of Montana. Dr. Naugle attributed the decline to farming, spraying, development and other disturbances, including the methane production. The species is currently being evaluated to see if it may qualify for protection under the Endangered Species Act.

Meanwhile, Campbell County is in the midst of a natural gas boom, with 10,000 to 15,000 wells, which are more like water wells than conventional gas wells, and analysts predict the total may exceed 80,000 in 10 years; with tens of thousands more in Montana. And that means more ponds. Along with the methane, each well pumps an average of 10 to 12 gallons of water a minute, and federal regulations require that the water, depending on its quality, be held in ponds to keep elevated levels of salts and metals from getting into other water sources.

Water is also released directly into streams and on the ground, and the huge volumes have turned ephemeral streams into year-round sources of water and created wet, spongy areas.

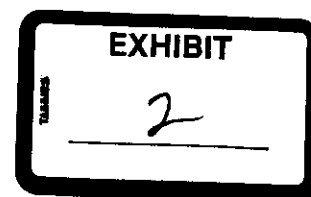
The Campbell County region, which normally gets just 13 inches of rain a year, has had a drought the last three years.

"In some areas of Campbell County the methane ponds are the only source of water" in the summer, said Dr. Greg Johnson, the head of the department of entomology at Montana State University in Bozeman. In trapping mosquitoes for research in Campbell County, he found both the genus and the species of adult and larval state of the mosquito that carries West Nile in and around the ponds. But another season is needed to make firm conclusions because the study area is so large.

Nancy Sorenson, a cattle rancher north of Gillette and the chairwoman of the Powder River Basin Resource Council, a group that opposes what members call the irresponsible disposal of excess water, believes that she had West Nile virus this summer.

She did not see a doctor, though, because she was told people were not being tested unless they were hospitalized, she said. The large ponds created by methane extraction near her ranch gave her pause, especially since some of the dead grouse were found on her property. "I had rain barrels in my yard, but because of West Nile I turned them all over," she said.

“The only standing water we had around here this summer was methane water,” because of a drought, she said.



Friday, Janu

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News Story Published On 11/10/2003

West Nile virus found in more sage grouse

By Amber Travsky
atravsky@wyoming.com
Published in the Wyoming Tribune-Eagle

CHEYENNE - Last August three sage grouse in Campbell County tested positive for the West Nile virus. Since then, a total of 22 sage grouse tested at the Wyoming State Veterinary Laboratory have tested positive.

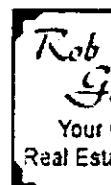
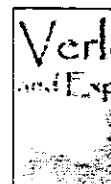
Todd Cornish, veterinary pathologist for the state lab, said 19 of those were found in Wyoming, and three were in Montana. Thirteen of the birds came from Campbell County, while one infected bird each came from Bighorn, Carbon, Fremont, Natrona, Sheridan and Sweetwater counties.

"We have samples pending on six more sage grouse, plus 100 hunter-killed birds to test," he said. The majority of birds yet to be tested are from southwest Wyoming, since that is where sage grouse hunting seasons were open this fall. Hunting seasons for sage grouse were closed in Johnson, Sheridan and Campbell counties of northeastern Wyoming due to concerns about the impact of the virus on the already struggling sage grouse population in that part of the state.

"Northeast Wyoming has comparatively small sage grouse populations that are semi-isolated," said Tom Christiansen, Wyoming Game and Fish Department sage grouse biologist. "When combined with all the other limiting factors these populations face, we thought it was best to close the area to hunting as a precaution."

The dead Campbell County grouse were part of a research study and were outfitted with radio collars. The infected birds were part of a study being conducted by the University of Montana and the Bureau of Land Management researching the impacts of coal-bed methane development on sage grouse. Researchers were able to locate the birds quickly by homing in on the signals emitted from the special collars.

"There may be similar deaths in other areas of the state," Cornish said.
"Because other birds lack radio collars, there's a chance that they are out there,



and we just haven't located them."

Legal
View
Legal

There's speculation that the concentration of infected birds in Campbell County is due indirectly to the boom in coal-bed methane extraction. With each methane well, the natural gas is mixed with ground water. Every well that pumps out methane also pumps out groundwater. Each well pumps an average of 10 to 12 gallons of water a minute, and federal regulations require that the water, depending on its quality, be held in ponds to keep elevated levels of salts and metals from getting into other water sources.

With 10,000 to 15,000 wells in operation or in the process of being constructed or permitted, the region is dotted with hundreds of new ponds to hold the excess water. Water also is being released directly into streams and on the ground, resulting in the transformation of ephemeral, or intermittent streams, into perennial or year-round water sources.

The first line of defense against the mosquito-borne virus is to get rid of standing water. Speculation is that the increase in ponds has increased the mosquito population, resulting in more cases of the West Nile virus.

Cornish said there's no proven evidence that the ponds and corresponding increase in surface water is increasing the spread of the virus.

"There's no proof of that at this point, but research will be conducted over the next couple years to look into the possibility," he said.

In addition to sage grouse, Campbell County has had 61 humans test positive for the virus and 15 horses. With 85 total West Nile detections, it is second in the state behind Goshen County, which has 151 detections.

Sage grouse aren't the only avian species being hit with the virus. Cornish said a range of raptor species have tested positive, including golden eagles, ferruginous hawks, kestrels, owls, red-tailed hawks, prairie falcons, goshawks and Cooper's hawk.

"It's also been found in the birds that few people seem to notice, such as magpies and songbirds," he said.

Nationwide, 200 different species have been infected with the virus.

"No one knows yet just what the impact will be on avian species," Cornish said. "All we know so far is that it kills a lot of birds."

Cornish has first-hand experience with the West Nile virus. He was one of the 356 Wyoming residents testing positive for the virus this year. Cornish said he was pretty sick, but many people who get it won't even know it.

"Not everyone who gets the virus gets sick," he said.

On the other end of the scale, though, are the extreme cases that result in death. Eight people have died in Wyoming because of the virus, and there have been 166 deaths nationwide.

People with mild infections may experience fever, headache, body aches, skin rash and swollen lymph glands. This is called West Nile fever. People with more severe infections may experience high fever, headache, neck stiffness,

stupor, disorientation, coma, tremors, convulsions and paralysis. This is called West Nile encephalitis.

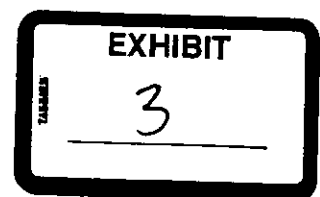
The West Nile virus season is over for 2003, but these human symptoms and the potential for more avian deaths is expected to return with mosquito season next spring. The West Nile-caused deaths of sage grouse are new, and the future impact of the disease across the range of the species is not yet known.

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West Nile isn't just for people

Coalbed methane development may be helping spread disease to wild birds

CODY, WYOMING

Wildlife biologist Terry Creekmore was studying sick prairie dogs in the South Dakota

Badlands in 1999, when the National Wildlife Health Center asked him to head east to New York City. Hundreds of crows were turning up dead in the city, and nobody knew why.

Creekmore took blood samples from 175 New York crows, and helped discover that the wild birds were suddenly being infected by something that was supposed to be far, far away: West Nile virus, which originated in Africa and the Middle East.

"West Nile virus was not diagnosed (initially) by the public-health people," says Creekmore, who's now with the Wyoming Department of Health, testing dead birds for traces of the virus by extracting their brain tissues. "It was diagnosed by the wildlife people."

Since the New York outbreak, West Nile virus has spread westward all the way to California, carried long distances by birds, and transmitted mainly by mosquitoes, which bite infected birds and then bite other animals. More than 8,000 people have been infected nationwide; more than 200 have died.

It's not clear why, but six of the nine states with the greatest number of human cases are in the West: Colorado, Wyoming, both Dakotas, Montana and New Mexico. Some speculate that the region's recent weather patterns have favored the virus. It just reached Utah, Nevada and Arizona this year, and though it has waned in the cold weather, it will likely show up in Oregon and Washington next spring.

Most of the attention focuses on people, as health departments issue warnings to use mosquito repellent, and TV news headlines sensational stories about elderly people stricken with the disease. But the virus is also beginning to take a toll on Western wildlife — and nobody knows how heavy that toll could become.

Adapting may be difficult

Most people exposed to West Nile virus don't get sick at all, or merely suffer flu-like symptoms. Less than 1 percent become severely ill, with symptoms that include meningoencephalitis (inflammation of the spinal cord and brain), high fever, convulsions, blindness, paralysis and coma.



Diane Morse, who runs Northeast Wyoming Bird Rehabilitation and Rescue, nurses an eagle she suspects has West Nile virus. The bird was blind and too weak to move, when it was discovered on the banks of the Tongue River. BRADY J. BONER GILLETTE NEWS RECORD

Wildlife casualties are tougher to measure. Species that live around humans — bats, chipmunks, skunks and squirrels — have been discovered with the disease. Most wild birds that die are never found, however, and few are ever collected for analysis, especially in the wide-open spaces of the West. But as word of the problem spreads, wildlife agents, hunters, ranchers and hikers have become more alert for dead birds, turning them in by the dozens for analysis.

Some bird species seem to be largely immune to West Nile, but some are hit very hard. The little evidence that exists is mainly found in relatively limited studies and in individual cases, but it shows that the virus is fatal in more than 200 species of birds in this country, including bald eagles, magpies and pheasants.

Infection is almost always fatal for

crows. Raptors, including hawks, owls and falcons, are also noticeably susceptible; their reported symptoms include blindness, paralysis and starvation.

Birds in Africa have adapted to the virus, and over time, North American birds may as well, says Todd Cornish, at the Wyoming State Veterinary Laboratory. A lot of factors play into resistance: genetics, the species' immune system, the dose of the virus (which depends on the mosquito). "If you get hit and you have the right genetic makeup, you're going to live and pass on those resistant genes to your offspring," Cornish says. "The ones who aren't resistant die."

This virus may thrive on methane

One species at risk is the sage grouse, which already has been reduced to a small fraction of its historic population (*HCN*, 2/4/02). Five studies in Montana, Wyoming and Canada show the virus beginning to hit grouse. About 20 grouse in Wyoming have been identified as casualties; most were found only because they were being monitored with radio-collars, in ongoing population studies.

The toll may become more noticeable over time — especially in areas impacted by the demand for natural gas. Tens of thousands of coalbed methane wells have been drilled recently from Montana to New Mexico, and all those wells pump groundwater to the surface along with the gas. This creates breeding grounds for virus-carrying mosquitoes.

Professors David Naugle at the University of Montana and Greg Johnson at Montana State University, who are researching for any possible link between methane development and the virus, say it's too early to draw conclusions. But some environmentalists and ranchers say there's bound to be a link.

Nancy Sorenson, a rancher near Gillette, Wyo., who sees the virus spreading in her area, told *The New York Times*, "The only standing water we had around here this summer was methane water."

The West's total grouse population still likely runs more than 100,000, but grouse expert Clait Braun, now retired from the Colorado Division of Wildlife, says small, isolated grouse populations are most at risk, because they have the lowest genetic diversity — the Gunnison sage grouse in western Colorado, for example, and about 1,000 greater sage grouse surviving in Washington. Braun says methane water may not be as much of a mosquito breeder as irrigated hayfields are, but adds that, in general, "My professional opinion is that a lot of birds are going to die."

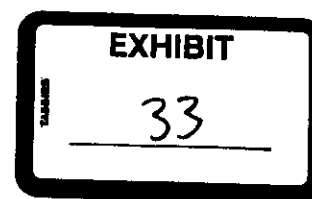
The question is: How much more can birds like the grouse — already under pressure — withstand? Cornish's lab is testing grouse to see if any of their immune systems have created antibodies to resist the virus. But as of early November, the first 24 grouse had tested negative.

BY KAREN MOCKLER

The author writes from Cody, Wyoming.

Centers for Disease Control, West Nile virus
www.cdc.gov/ncidod/dvbid/westnile/index.htm

Terry Creekmore and Todd Cornish at the Wyoming State Veterinary Laboratory in Laramie, 307 742 5638



UNITED STATES COURT OF APPEALS
FOR THE TENTH CIRCUIT

WYOMING OUTDOOR COUNCIL, et al.,)	
)	No. 04-8023
Petitioners,)	
)	DECLARATION OF DR. LARRY
vs.)	MUNN IN SUPPORT OF
)	PETITIONERS' MOTION FOR
U.S. ARMY CORPS OF ENGINEERS,)	INJUNCTION PENDING
)	APPEAL
Respondent.)	
<hr/>		

I, Dr. Larry Munn, do hereby declare as follows:

1. The facts set forth in this affidavit are based on my personal knowledge. If called as a witness in these proceedings, I could and would testify competently to these facts. As to matters that reflect a matter of opinion, they reflect my personal opinion and best judgment on the matter.

2. I live in Laramie, Wyoming. I am a Professor of Soil Science in the Department of Renewable Resources at the University of Wyoming. I have worked in that capacity since 1981.

3. I have a Ph.D. in rangeland soils from Montana State University. My Ph.D. dissertation addressed native range soils in the western one-third of Montana. I earned a Master's Degree in natural resources and a B.S. in agronomy (soil science) from Ohio State University. I worked for three years after finishing my Ph.D. in Montana as a research scientist before joining the faculty at the University of Wyoming.

4. I have taught water management and irrigation water quality issues in classes every year for the past twenty years at the University of Wyoming and therefore stay informed of current research. I have also provided comments to the U.S. Bureau of Land Management on

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draft Environmental Impact Statements regarding CBM development in the Powder River Basin and its effect on soils and vegetation.

5. I have provided soil and vegetation analysis and information for numerous ranchers as part of the University of Wyoming's outreach programs, including landowners and irrigators in the Gillette area, along the Cheyenne River, and in Niobrara County in Wyoming, as well as along the Tongue River in Montana, the Cheyenne River in South Dakota, and other sites. In this capacity, I respond to landowners' requests about the adverse impacts of upstream coal bed methane (CBM) development and reservoir operations on their irrigation practices. As a part of this activity, I analyze data to assess impacts to soils and vegetation from CBM.

6. My opinions in this declaration are based in large part on the extensive literature developed by the agricultural community through experience with thousands of years of irrigation and approximately one hundred years of scientific research on the effects of salinity on irrigation water, as well as my analyses of field data acquired through the University's extension outreach.

7. The quality of the CBM water in the Powder River Basin varies greatly depending on the particular coal seam from which it is extracted. In general, groundwater quality is best south of Gillette, where it can be used for livestock watering and irrigation. However, water quality declines in developing CBM resources northwest of Gillette, toward Sheridan and into Montana -- water that is unsuitable for growing plants, and it is sometimes unsuitable for watering livestock.

8. CBM water introduces salts and sodicity to the Powder River Basin and is substantially changing the agricultural use of the ephemeral streams in this region of Wyoming. When the water is heavily laden with salts, native plants are adversely affected. It takes far more energy for plants to remove water from salt-affected soils, which causes the plants to wilt earlier in the day, decreasing photosynthesis and plant production. High levels of salinity in the soil are toxic to plants. The simplest measure of the salt load in water is to use the electrical conductivity (EC) of the water. The more salt the water contains, the more readily it conducts electricity, so

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that the EC is higher. In the Powder River Basin in Wyoming, CBM water has been measured by the U.S. Geological Survey with EC levels between 500 micro-mhos/cm and 3,000 micro-mhos/cm (Rice, C.A., M.S. Ellis and J.H. Bullock, Jr. 2000. Water Co-Produced with Coalbed Methane in the Powder River Basin, Wyoming: Preliminary Compositional Data. Open File Report 00-372. U.S. Geological Survey, Denver, CO.) Crops and native plants in Wyoming have different salt tolerances. Some crops can stand much higher salinity levels than others without experiencing yield reductions. For example, wheat yield tends to decrease when salinity in irrigation water reaches an EC of 4,000 micro-mhos/cm, while alfalfa yield tends to decrease at 1,300 micro-mhos/cm, and corn grown for grain has a yield reduction threshold of 1,200 micro-mhos/cm. Salinity problems typically get worse over time as more salty water is added to the soil repeatedly. Water is lost from the soil through plant transpiration and by evaporation from the surface. Irrigators must then add water to the crops above their normal needs to "leach" excess salts from the root zone. Without annual leaching, salinity will continue to build up in the soil over time, eventually prohibiting plant growth, especially if the soil has slow permeability. The salts in the leaching water may present a serious disposal problem.

9. In addition to increased salinity, CBM water also often has high levels of sodicity. Sodicity is a different, and often separate, problem from salinity. Naturally occurring sodium-affected soils are sometimes observed as "pan spots" on rangeland, which are typically sparsely vegetated and usually have a very hard consistency when dry. Soils in semi-arid environments, and with high clay content, such as those in the Powder River Basin, are most affected by sodicity. Sodicity is usually calculated by using the sodium adsorption ratio (SAR), which is the ratio of sodium to calcium and magnesium. SARs have been observed in Wyoming's Powder River Basin to range from 2 to 50 or higher. A SAR level of 8 to 10 is the upper limit usually recommended for application to crop fields. The major negative effect of high sodicity in irrigation water is to reduce infiltration rates and permeability of the soil. High sodium content in irrigation water makes it difficult for the irrigators to achieve good water distribution and

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quickly increases salinity problems. High sodium levels can also cause crusting of the soil, which limits the success of germination.

10. The main problem for landowners who are downstream of CBM reservoirs is that even if they are able to leach the excess salts from their crop fields, the salt must go somewhere. For example, if a landowner has a high level of salt in a hayfield, the landowner can flush the salt and drain it to a stream. However, the high salt levels will then be present in the stream, causing impacts to the soil and vegetation along the stream. There are various schemes for getting rid of CBM water and its salt, but all have drawbacks and none of them work to restore the land to its condition before the addition of the CBM water. The salt load of even the best CBM water seriously damages the area's native vegetation and common crops without annual leaching. However, because many of the soils in the Powder River Basin are clayey and shallow or only moderately deep, annual leaching is not practical with large amounts of CBM water being produced. Much of the CBM water is too saline and/or too sodic to be used for irrigating crops in the Powder River Basin without yield reductions and damage to the crop fields.

11. I am familiar with Ed Swartz's operation because I have talked with Mr. Swartz and I have looked at pictures of his land, including Wildcat Creek. I am aware that Mr. Swartz, like many ranchers, uses spreader dikes in irrigating his fields. I do not believe the spreader dikes are the cause of the changes to Wildcat Creek. Landowners have used spreader dikes for years without building up any salt problems, even over the long term. As long as the water the landowner is spreading is fairly high quality, there is not likely to be a salt buildup. In fact, the federal government, through the Natural Resources Conservation Service, has helped subsidize the construction of spreader dikes for years because they are an effective means of irrigating landowners' fields.

12. I am familiar with the Water Quality Control Report concerning the results of the water sample from Dead Horse Creek that Eric Barlow had tested on his own land in May 2003. See WOC's Exhibit 27 to Preliminary Injunction Motion. The EC levels of 3,720 and 3,710 would affect many common crops. These levels would certainly produce a yield decrease for

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alfalfa, which has a threshold of 1,300 mhos/cm. If Mr. Barlow irrigated alfalfa with that water, he could expect an approximate twenty percent decline from the production he would get with good quality water. Additionally, the report states an SAR of 8.62 and 8.57. This level is high enough that it is a concern for soils with a high clay content, which are the predominant type of soil in the Powder River Basin, because it will likely cause infiltration problems. As a landowner with these water quality results, I would not want the SAR to climb any higher, and the salinity levels are already in the zone where crop reductions may occur. It should be noted that water with an EC in the 3,700 micro-mhos/cm range would contain approximately 3 tons of salt per acre-foot of applied water.

13. I am familiar with the report, "Whole Effluent Toxicity Testing of CBM Produced Water in Northeastern Wyoming," published by the Wyoming Department of Environmental Quality on October 30, 2003. This report supports the understanding that CBM water quality is poorer on the northwest side of the Powder River Basin as compared to the southeast portion of the Basin and that water from the Big George coal seam has trace element contamination that is toxic to fish and other aquatic organisms.

14. CBM water is changing ephemeral streams in the Powder River Basin in other ways as well. The over-riding problem associated with the CBM water is its sheer volume (more than 3,000,000 acre-feet by 2017 according to the U.S. Bureau of Land Management's estimate in the 2003 EIS by the Buffalo Field Office) and the enormous quantity of salt that will be transferred from the geologic formations to the surface landscape (3,500,000 tons of salt according to the predictions in the EIS). Natural precipitation in the Powder River Basin is concentrated in the spring, and many streams carry water only during snow melt and after thunderstorms. CBM water, which flows year round, may flood these streams when plants are dormant or when there is no natural precipitation to dilute the CBM water. Year-round flow of CBM water raises groundwater tables and prevents or slows infiltration, causing an increase in runoff from individual storm events.

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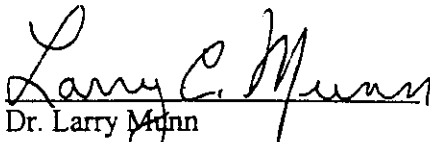
15. In addition to these impacts, the native vegetation is changing as a result of the salt content of CBM water. Studies that have already been performed and the data that has been collected in the Powder River Basin show that native plant species inundated with CBM water are being replaced by salt-tolerant species such as bull rush and fox-tail barley (LaFantasie, J., M.J. Patz, Q.D. Skinner, K.J. Reddy. 2004. Effects of Coalbed Methane Discharges on Stream Channel Vegetation. Abstract no. 207, p 97. Society for Range Management. 57th Annual Meeting. January 24-30. Salt Lake City, Utah). Most of these species, while providing protection of the channel from erosion, are not very palatable for livestock or wildlife. One salt-tolerant species, fox-tail barley, is palatable at the beginning of the season, but eventually grows spike awns on its seedheads that cause infection in the mouths of grazing animals, both livestock and wildlife. The change to salt-tolerant, less palatable species are part of an expected pattern when dry, non-saline soils in ephemeral channels are converted to wet, saline soils as the streams flow year around with added CBM water. Before the addition of CBM water, the ephemeral drainages comprised some of the most productive grazing sites in the Powder River Basin rangelands. The carrying capacity is lost when the native upland vegetation is replaced with unpalatable salt tolerant plants.

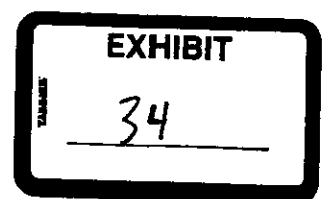
16. Once CBM production stops, the soils will undergo another significant change. The salt-dependent species that have replaced native vegetation will die off because they require wet saline soils. The original native species that grew on the site will not be able to come back because the soils will now be highly saline. These transformed saline soils will have less plant cover, and highly sodic soil will often be bare. These bare soils will also increase erosion along the streams. The condition of the channels after CBM water additions have ceased will be conducive to erosion and will require decades if not centuries to return to their pre-disturbance condition.

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Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on March 16, 2004, in Laramie, WY


Dr. Larry Munn



FILED
U.S. DISTRICT COURT
DISTRICT OF WYOMING
JAN - 5 2004

Betty A. Griess, Clerk
Cheyenne

UNITED STATES DISTRICT COURT
FOR THE WYOMING

WYOMING OUTDOOR COUNCIL, et al.,

Petitioners,

VS.

U.S. ARMY CORPS OF ENGINEERS,

Respondent.

Case No. 02-CV-155-D

DECLARATION OF JAMES
GORE IN SUPPORT OF
PETITIONERS' MOTION FOR
PRELIMINARY INJUNCTION

I, James Gore, hereby state and declare as follows:

1. The facts set forth in this affidavit are based on my personal knowledge, or based on facts that an expert would reasonable rely upon. As to matters that reflect a matter of opinion, they reflect my professional opinion and my best judgment on the matter based upon the body of available scientific evidence.

2. I have a Ph.D. in Zoology and Master of Arts in Zoology from the University of Montana. My Baccalaureate degree in Zoology is from the University of Colorado. My complete resume is attached as Exhibit 1. My doctoral research at the University of Montana was a study of the trophic status of mayflies in lake outlet ecosystems. My Master's degree and a portion of my doctoral work included an analysis of instream flow requirements of macroinvertebrates in the Tongue River, in eastern Montana. During my time as research associate with the Water Resources Research Institute at the University of Wyoming, I completed several studies on the impacts of energy development, ranging from coal surface mining and river restoration on the

Tongue River to the potential impacts of in situ uranium mining on the Powder River, near Buffalo, Wyoming.

3. Since obtaining my Ph.D. in 1981, I have worked in various academic and research positions in river biology, including a position as research aquatic biologist at the University of Wyoming, assistant and associate professor at the University of Tulsa, where I was also guest professor, the University of Karlsruhe and the University of Cape Town (on a Fulbright Fellowship) and research ecologist at the U.S. Army Waterways Experiment Station. I have also served as Director of the Center for Field Biology, Austin Peay State University, Tennessee. For a short period of time I also held an Endowed Chair in Environmental Science at Troy State University, Alabama, and worked as director of the Environmental Protection Division of the Conservancy of Southwest Florida, Naples, Florida.

4. I am currently Professor and Chair, Department of Environmental and Health Science, at Columbus State University in Georgia, a position I have occupied for seven years. I also serve on the Scientific Advisory Board – United Nations/UNESCO – International Hydrology Program (IHP) – section on ecohydrology. Recently, I presented research papers on Coal Bed Methane impacts to aquatic resources at the 9th and 10th International Petroleum Environmental Conferences, held in Albuquerque, NM, and Houston, TX, on Oct 22 - 25, 2003 and Nov. 11-14, 2003, respectively. The research paper from the Albuquerque meeting and the abstract from the Houston meetings is attached hereto as Exhibit 2.

5. For several years, I have studied, and reviewed literature on, the specific effects of discharging coalbed methane (CBM) produced waters into the rivers and tributaries in the Powder River Basin as well and other waterways in northeast Wyoming

and southeast Montana. Based on my studies and review, the discharge of CBM produced waters is causing serious adverse consequences to aquatic systems. In particular, increased river flows from CBM water discharges in Northeastern Wyoming could eliminate up to 30 aquatic species within 20 years, including the endangered Western silvery minnow that is found in Wyoming's Powder River and Belle Fourche River. In all, I expect the elimination of 10% of native aquatic species from Northeastern Wyoming.

6. Natural flowing rivers, when undammed, are turbid and have sandy-bottoms. These rivers and their tributaries frequently shift course and have wide fluctuations in their flow regime. The nutritional energy driving prairie streams is mostly from soil nutrients, leaves, and branches that blow or fall into the stream. These materials lodge in particular places and are colonized by bacteria and fungi. Both this lodgement within the stream and its colonization are important in the preparation of this material for use by plants and animals as vital food. Native fish, riparian plants, algae, and macro-invertebrates have specially adapted to this unique natural landscape.

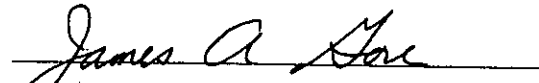
7. The discharge of large volumes of CBM produced water into this natural environment has serious consequences. The seasonal nature and timing of the natural flow regime will be altered because CBM produced water will be discharged at a constant flow and high volume all year long. Streams that were naturally slow-moving and sandy-bottomed will become fast-moving and rapid currents remove and dislodge the sandy characteristics found at the bottom of streams. The entire nature of the streambed (the "benthos") will be almost completely changed. Some ephemeral and intermittent streams in the Powder River basin become perennial. As a result of increased water flows, the natural river habitat is eliminated or reduced extensively.

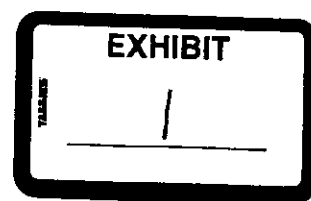
8. The dramatic changes to this aquatic environment seriously and adversely ~~impact aquatic species~~. Any organism, if forced to live outside its adapted range of living conditions, can be drastically affected by changes in those living conditions.

9. ~~Species native to prairie streams are likely to be eliminated~~ due to the construction of dams and reservoirs and the discharge of produced waters into the reservoirs. Fishes such as the sturgeon chub, western silvery minnow, and shovelnose sturgeon are likely to be eradicated. Five of the country's rarest mayflies will become more endangered, and may be extirpated over time. By eliminating shallow water habitat areas, the river's food chain (snails, shrimp, worms and insect larvae) is disrupted and cannot provide a food source for newborn fish. In some cases, the faster flowing water damage an organism's filtering nets that strain food particles from the water and thereby cause the organism to starve. For other species, the faster flowing waters do not allow benthic species to forage for food or provide adequate breeding habitat for egg production, ultimately leading to the extirpation of that species. The long-term threat of increased flows could eventually ~~also impact the life span of the existing fish~~ and other organisms in the prairie rivers of northeast Wyoming that use shallow water habitats for feeding and cover. Of course, this also impacts the ~~recreational fishing~~ in Northeast Wyoming.

10. These conclusions are based on ~~computer models~~ and the prediction that the discharge of CBM produced waters will be significantly increasing in the Powder River Basin and throughout the State of Wyoming and that CBM well can generated as much as 17,000 gallons of salt water daily. They are also based on the fact that unlined reservoirs allow an estimated ~~amount of salt water~~ enter the natural aquatic environment.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief and that this declaration was executed on December 18, 2003, in Columbus, Georgia.


James Gore



CURRICULUM VITA

James A. Gore

Date of Birth: 3 Sept 1949

Birthplace: Los Alamos, NM

Current Position: Professor/Director, Environmental Science Graduate Program
Chair, Dept. of Environmental and Health Sciences
[Tenured 1998]

Columbus State University
College of Science
Columbus, GA 31907-5645

Work: (706) 568-2067
FAX: (706) 569-3133

Home: (706) 653-1079
email: gore_james@colstate.edu

EDUCATION:

B.A. (Zoology; Minor: Botany) University of Colorado (1971)

(Senior Research: A computer model of evapotranspiration rates and water availability in the Colorado alpine tundra.)

M.A. (Zoology; Minor: Geology) University of Montana (1976)

(Thesis: In-stream flow requirements of benthic macroinvertebrates in a prairie river.)

Ph.D. (Zoology; Minor: Hydrology) University of Montana (1981)

(Dissertation: Trophic ecology of mayflies (*Ephemeroptera*) in natural and laboratory streams.)

Areas of Specialization

Aquatic ecology/Hydrology/Conservation. Hydrodynamic and hydraulic change as an influence on the distribution of aquatic biota. Habitat modeling and instream flow requirements of aquatic biota as a means of regulated river management. Human impacts (primarily from energy development technologies) upon running water ecosystems, with emphasis on benthic macroinvertebrates. Habitat restoration for lotic ecosystems. Impacts and flow management of hydroelectric facilities, particularly peaking hydropower. Ecology of arid and semi-arid rivers of southern Africa. Distribution of Chironomids as indicators of the ecological integrity of wetland

ecosystems. Bioassessment of lotic ecosystems using GIS filters to pick reference sites and conditions combined with physical and biological metrics to create a numerical stream classification system. Water quality and biotic distributions related to coal mine and other petroleum development technologies. Biology and ecology of invertebrates, especially aquatic insects and solpugids [Solifugidae] (sun spiders).

Professional Experience

- Associate Professor/Professor (1996 – Present), **Director**, Graduate Program in Environmental Science, **Chair**, Department of Environmental and Health Sciences, Columbus State University, Columbus, GA
- Adjunct Professor (1989-Present), Dept. of Biology, Tennessee Tech Univ., Cookeville, TN
- Senior Scientist/Director (1994-1996) Environmental Protection Division, The Conservancy of Southwest Florida, Naples, FL
- Eminent Scholar Chair in Environmental Sciences (1992-1994) Center for Environmental Research and Service, Troy State University, Troy, AL
 - While at Troy State University, also served as:
 - Executive Director (1992 - 1993) Choctawhatchee-Pea Rivers Watershed Management Authority, Troy, Alabama
- Professor and Director of Research (1990-1992) The Center for Field Biology, Austin Peay State Univ., Clarksville, TN
- Associate Professor/Assistant Professor (1981-1990) (Tenured 1986) Faculty of Biological Science, University of Tulsa, Tulsa, OK

While on the Faculty of the University of Tulsa, also served as:

- Visiting Professor (1989) Freshwater Research Unit, Dept. of Zoology, University of Cape Town, South Africa (**Fulbright Fellowship**)
- Guest Faculty (Summer, 1988) Univ. of Oklahoma, Biological Station, Lake Texoma - taught Reservoir and Tailwater Ecology
- Research Ecologist (1986-1988) [Water Quality Modeling Group], U.S. Army ~~Corps of Engineers~~, Waterways Experiment Station, Vicksburg, MS (Sabbatical from Univ. Of Tulsa, 1986-1987, IPA assignment and research grant)
- Guest Professor (Summer, 1985) Zoologisches Institut der Universitat (T.H.), Karlsruhe, West Germany

- Research Associate (1980-1981) Tennessee Cooperative Fisheries Research Unit, Tennessee Tech. Univ., Cookeville, TN (**Post-Doc**)

While working on Master's and Doctoral Degrees

- o Research Aquatic Biologist (1978-1980) Water Resources Research Institute, University of Wyoming, Laramie, WY
- o Instructor (1976-1978) Dept. of Zoology, University of Montana, Missoula, MT
- o Research Assistant (1974-1976) Dept. of Geology, Univ. of Montana, Missoula, MT

Military Service: U.S. Navy (1971-1974) [Operational Electronics/Avionics]
Vietnam (1972-1973)

Professional Memberships

American Association for the Advancement of Science
American Fisheries Society
American Institute of Biological Sciences
American Society of Naturalists
North American Benthological Society
(Executive Committee, 1986-1987)
(Chair, Technical Issues Committee, 1986-1988; member, 1986 - Present)
Phi Gamma Kappa
(Vice-President, 1985-1986)
Sigma Xi
Southern African Society of Aquatic Scientists
New Zealand Limnological Society
Phi Beta Delta (Honor Society for International Scholars)

Honors/Awards

FULBRIGHT SENIOR RESEARCH FELLOWSHIP - Council for the International Exchange of
Scholars - Freshwater Research Unit, Univ. of Cape Town, South Africa - regulated river
management projects - Jan 1989 - Sept 1989

U.S. Dept. of Energy/Assoc. of Western Universities Faculty Research Participation Award - Laramie Energy Technology Center, Univ. of Wyoming - toxicology research - Summer, 1983

Assoc. of Western Universities/ U.S. Dept. of Energy Fellowship - Western Research Institute, Univ. of Wyoming - toxicology of treated synfuel effluents - Summer, 1984.

Columbus State University – Faculty Research and Scholarship Award – 2000

Listed:	Who's Who in the South and Southwest	[Marquis] (1985, 1996, 1999-2000)
	Who's Who in Science and Engineering	[Marquis] (1989, 1995-1998, 2003-04)
	Who's Who in America	[Marquis] (1992, 1998-2004)
	Who's Who in Medicine and Health Care	[Marquis] (1999-2003)
	Who's Who Environmental Registry	[Citation Press] (1992)
	American Men and Women of Science	(1992)
	Who's Who in the World	[Marquis] (1995-2004)
	Men of Achievement	[Melrose, UK] (1996)
	Int. Directory of Distinguished Leadership	[Amer. Biog. Inst.] (1996)
	International Who's Who of Professionals	[2000]
	Who's Who in America's Teachers	[2003]
	Who's Who in American Education	[Marquis] (2004-2005)

Publications in Refereed Journals

[most influential (i.e., most cited) are in **bold**]

Gore, J.A. 1977. Reservoir manipulations and benthic macroinvertebrates in a prairie river. *Hydrobiologia* 55: 113-123.

Gore, J.A. 1978. A technique for predicting the in-stream flow requirements of benthic macroinvertebrates. *Freshwater Biology* 8: 141-151.

Gore, J.A. 1979. Patterns of initial benthic recolonization of a reclaimed coal strip-mined river channel. *Canadian Journal of Zoology* 57: 2429-2439.

Gore, J.A., and B.S. Cushing. 1980. Observations on temporary foraging areas and burrows of the sun spider, *Ammotrechula penninsulana* (Banks) (Arachnida: Solpugida). *Southwestern Naturalist* 25: 95-102.

- Gore, J.A. 1980. Ordinal analysis of benthic communities upstream and downstream of a prairie storage reservoir. *Hydrobiologia* 69: 33-44.
- Gore, J.A., and L.S. Johnson. 1981. Restoration of surface mined rivers in the Northern Great Plains. *Water Spectrum* 13: 31-38.
- Gore, J.A., and R.D. Judy, Jr. 1981. Predictive models of benthic macroinvertebrate density for use in instream flow studies and regulated flow management. *Canadian Journal of Fisheries and Aquatic Science* 38: 1363-1370.
- Gore, J.A. 1982. Benthic invertebrate colonization: source distance effects on community composition. *Hydrobiologia* 94: 183-194.
- Gore, J.A. 1983. The distribution of desmognathine larvae (Amphibia: Plethodontidae) in coal surface mine impacted streams of the Cumberland Plateau, USA. *Journal of Freshwater Ecology* 2: 12-23.
- Gore, J.A. 1984. Comment: Potential errors in P/R measurements by the methods of Pavletic, Matonickin, Stilinovic, and Habdija. *Hydrobiologia* 118: 213-214.
- Gore, J.A., and W.A. Swartley. 1985. Distribution of mayfly nymphs in relation to water quality of streams draining coal surface-mined areas on the Cumberland Plateau. *American Fisheries Society, Special Publication, Water Quality Section*, pp. 59-73.
- Gore, J.A., and R.M. Bryant, Jr. 1986. Changes in fish and macroinvertebrate assemblages along the impounded Arkansas River. *Journal of Freshwater Ecology* 3: 333-345.
- Gore, J.A., and J.M. Nestler. 1988. Instream flow studies in perspective. *Regulated Rivers* 2: 93-101.
- Statzner, B., J.A. Gore, and V.H. Resh. 1988. Hydraulic stream ecology: observed patterns and potential applications. *Journal of the North American Benthological Society* 7: 307-360.
- Gore, J.A., J.M. Nestler, and J.B. Layzer. 1989. Instream flow predictions and management options for biota affected by peaking hydropower releases. *Regulated Rivers* 3: 35-48.
- Layzer, J.B., T.J. Nehus, W. Pennington, J.A. Gore, and J.M. Nestler. 1989. Seasonal variation in the composition of the drift below a peaking hydro-electric project. *Regulated Rivers* 3: 29-34.
- Gore, J.A. 1989. Setting priorities for minimum flow assessments in Southern Africa. *South African Journal of Science* 85: 614-615.

- Gore, J.A. 1989. Case histories of instream flow analyses for permitting and environmental impact assessments in the United States. *South African Journal of Aquatic Sciences* 15: 194-208. (INVITED PAPER)
- Gore, J.A., and R.M. Bryant, Jr. 1990. Temporal shifts in physical habitat of the crayfish, *Orconectes neglectus* (Faxon). *Hydrobiologia* 199: 131-142.
- Gore, J.A., and A.M. Milner. 1990. Island biogeographic theory: can it be used to predict lotic recovery rates? *Environmental Management* 14: 737-753.
- Gore, J.A., J.R. Kelly, and J.D. Yount. 1990. Application of ecological theory to determining the recovery potential of disturbed lotic ecosystems: Research needs and priorities. *Environmental Management* 14: 755-762.
- Gelwick, F.P., and J.A. Gore. 1990. Fishes of Battle Branch, Delaware County, in northeastern Oklahoma. *Proceedings of the Oklahoma Academy of Science* 70: 13-18.
- Gore, J.A., J.M. King, and K.C.D. Hamman. 1991. Application of the Instream flow incremental methodology (IFIM) to southern African rivers. I. Protecting endemic fish of the Olifants River. *Water SA* 17: 225-234.
- Niemela S., J.B. Layzer, and J.A. Gore. 1993. An improved radiotelemetry method for determining use of microhabitats by fishes. *Rivers* 4: 30-35.
- Gore, J.A., Niemela, S., Statzner, B., and V.H. Resh. 1994. Near substrate hydraulic conditions under artificial floods from peaking hydropower operation: disturbance intensity and duration. *Regulated Rivers* 9: 15-34.
- Gore, J.A., and F.D. Shields, Jr. 1995. Can large rivers be restored? *BioScience* 45: 142-152.
- Gore, J.A., and S.W. Hamilton. 1996. A comparison of flow-related habitat evaluations downstream of low-head weirs on small and large fluvial ecosystems. *Regulated Rivers* 12: 459-469.
- Gore, J.A., D.J. Crawford, and D.S. Addison. 1998. An analysis of artificial riffles and enhancement of benthic community diversity by Physical Habitat Simulation (PHABSIM) and direct observation. *Regulated Rivers* 14: 69-77.
- Statzner, B., J.A. Gore, and V.H. Resh. 1998. Monte Carlo simulation of benthic macroinvertebrate populations: Estimates using random, stratified, and gradient sampling. *J.N. Am. Benthol. Soc.* 17: 324-337.

- Timchenko, V., O. Oksiyuk, and J.A. Gore. 2000. A model for ecosystem state and water quality management in the Dnieper River delta. *Ecological Engineering* 16: 119-125.
- Schuller, D., H. Brunken-Winkler, P. Busch, M. Förster, P. Janiesch, R. v. Lemm, R. Niegringhaus, H. Straßer, and J.A. Gore. 2000. Sustainable land use in an agriculturally misused landscape in northwest Germany through ecotechnological restoration by a "Patch-Network-Concept." *Ecological Engineering*.
- Gore, J.A. 2001. Models of Habitat Use and Availability to Evaluate Anthropogenic Changes in Channel Geometry. Pp 27-36 in: J. Dorava (ed.) **American Geophysical Union Monograph Geomorphic Processes and Riverine Habitat**. Water Science and Application, Volume 4.
- Gore, J.A., J.B. Layzer, and J. Mead. 2001. Macroinvertebrate instream flow studies after 20 years: a role in stream and river restoration. *Regulated Rivers* 17: 527-542.
- Addison, D.S., J.A. Gore, J. Ryder, and K. Worley. 2002. Tracking post-nesting movements of loggerhead turtles (*Caretta caretta*) with sonic and radio telemetry on the southwest coast of Florida, USA. *Marine Biology* 141: 201-205.
- Gore, J.A., F.E. Bryant, and H.L. Lindsay, Jr. (Submitted) Resource partitioning and food availability for co-existing darter species (Percidae) in parallel watersheds. Implications for instream flow analysis using target fish species. *Regulated Rivers*
- Gore, J.A., and J.B. Layzer. (Submitted) Bridging the gap: The role of benthos in instream flow assessments. *J.N. Am. Benthol. Soc.*
- Gore, J.A., D.S. Addison, S.C. Nichols, D.W. Ceilley, and P.A. Stansly (Submitted) The distribution of larval midge (Diptera: Chironomidae) assemblages in isolated wetlands of south Florida. *Amer. Midl. Nat.*
- Gore, J.A., and W.F. McTernan. (Submitted) Composition and macroinvertebrate toxicity of synfuel effluent waters. *Arch. Environ. Contam. Toxicol.*

Manuscripts in Preparation

- Gore, J.A., V.H. Resh, and B. Statzner. Physical habitat shifts in final instars of *Hydropsyche angustipennis* (Curtis).
- Gore, J.A., J.H. O'Keeffe, and A.A. Fouts. Application of the instream flow incremental methodology (IFIM) to southern African rivers. II. Prediction of relative abundances of fish and benthos at minimum flows.

Gore, J.A., and J.M. King. Application of the instream flow incremental methodology (IFIM) to southern African rivers. III. IFIM evaluations of flows to restore ecosystem integrity.

Gore, J.A., J.M. Nestler, L.T. Curtis, and J.M. Martin. Use of a dynamic flow hydraulic model linked to physical habitat simulations for estimating the impact of peaking power generation on adults and juveniles of rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). (Invited by Regulated Rivers)

Gore, J.A., and P.M. Jones. Distribution of Chironomidae in the mainstem Chattahoochee River and cumulative impacts of a combination of low and high-head impoundments.

Olson, J.R., J.A. Gore, and M. Barbour. A GIS-based method for choosing candidate reference streams in the ecoregions of Georgia: Comparisons with *best professional judgement*.

Gore, J.A., W.S. Birkhead, D.L. Hughes, S.L. Nichols, and T.W. Roever. Recovery and colonization dynamics of macroinvertebrates and fish in newly created habitat after sediment remediation from manufactured gas processing waste in the Oconee River.

Professional Presentations

Fort Union Coal Field Symposium. 1975. Billings, MT. Presented Paper: Fall-winter distribution of benthic macroinvertebrates in the Tongue River, Montana.

North American Benthological Society. 1976. LaCrosse, WI. Presented Paper: Effects of temporary massive flow reductions on benthic invertebrates of a prairie river.

American Society of Limnology and Oceanography. 1977. San Francisco, CA. Presented Paper: In-stream flow requirements of benthic macroinvertebrates as a means of minimum flow recommendations.

North American Benthological Society. 1978. Winnipeg, Manitoba. Presented Paper: A dendrogram analysis of long-term effects of channelization on stream benthos.

American Fisheries Society, CO-WY Chapter. 1979. Laramie, WY. Presented Paper: Fisheries recolonization of a channel of the Tongue River reclaimed after coal strip mining.

First International Symposium on Regulated Streams. 1979. Erie, PA. INVITED PAPER: An ordination analysis of benthic communities influenced by a prairie irrigation reservoir.

North American Benthological Society. 1979. Erie, PA. Presented Paper: Trends in recolonization and diversity of benthos in a reclaimed coal strip-mined river.

National Symposium on Strategies for Fish and Wildlife Mitigation (The Mitigation Symposium). 1979. Fort Collins, CO. Presented Paper: Biotic recovery of reclaimed channels after coal strip mining.

American Society of Limnology and Oceanography. 1980. Los Angeles, CA. INVITED PAPER: Colonization theory applied to benthic stream ecosystems.

North American Benthological Society. 1980. Savannah, GA. INVITED PAPER: Models of biotic recovery in strip mined river channels.

North American Benthological Society. 1981. Provo, UT. INVITED PAPER: Macroinvertebrate instream flow habitat preferenda: a component of regulated flow management in the Rocky Mountains.

Ann. Mtg., South. Div., Amer. Fish. Soc. and Southeastern Assoc. Fish. Wildl. Agencies. 1981. Tulsa, OK. Presented Paper: Chironomid communities as indicators of water quality affected by acid mine drainage.

North American Benthological Society. 1982. Ann Arbor, MI. Presented Paper: Effects of metals and other strip mine pollutants on benthic communities in the New River drainage, Tennessee.

North American Benthological Society. 1983. LaCrosse, WI. Presented Paper: Distribution of benthic macroinvertebrates along the impounded Arkansas River.

American Fisheries Society. 1983. Ann. Mtg. Milwaukee, WI. INVITED PAPER: Distribution of mayfly nymphs in relation to water quality of streams draining coal surface-mined areas on the Cumberland Plateau.

North American Benthological Society. 1984. Raleigh, NC. Presented Paper: Comparison of toxicity of treated condensate from underground coal gasification to *Daphnia* and selected mayfly species.

Univ. of Texas-Dallas, Environ. Sci. Colloquium. 1984. Dallas, TX. INVITED PAPER: Composition and toxicity of synfuel effluents to *Daphnia* and selected mayfly species.

North American Benthological Society. 1985. Corvallis, OR. Presented Paper: Diet and habitat preference of four co-existing darter species in an Ozark stream.

Third International Symposium on Regulated Streams. 1985. Edmonton, Alberta. INVITED PLENARY SESSION PAPER: Development and application of macroinvertebrate instream flow models for regulated flow management.

Waterways Experiment Station. 1986. Vicksburg, MS. INVITED SEMINAR: Modifications and alternatives for instream flow models predicating the effects of flow alterations on benthic invertebrates.

North American Benthological Society. 1986. Lawrence, KS. Presented Paper: Stream hydraulics as a determinant of microhabitat shifts in the crayfish, *Orconectes neglectus* (Faxon).

Fifth International Symposium on Trichoptera. 1986. Lyon, France. Presented Paper: Physical habitat characteristics and microdistribution of final instars of *Hydropsyche angustipennis* (Curtis).

European Entomological Congress. 1986. Amsterdam, The Netherlands. Presented Paper: Microdistribution of *Aphelocheirus* in relationship to physical characteristics of the stream reaches.

Workshop on Environmental Aspects of Local Flood-Protection Projects. 1986. Waterways Experiment Station, Vicksburg, MS. Presented Paper: The physical habitat simulation (PHABSIM) system: overview and potential application to local flood-protection projects.

Sixth Annual Fisheries and Limnology Colloquium. 1987. Land-Between-The-Lakes, Kentucky. INVITED PAPER: Research needs for instream flow assessments.

National Science Foundation. Workshop on Prairie Stream Ecology. 1987. Univ. of Oklahoma, Biol. Stn., Lake Texoma, OK. INVITED PAPER: Applied hydraulics in stream research.

North American Benthological Society. 1987. Orono., ME. INVITED PLENARY SESSION PAPER: Physical habitat simulations for benthos applied to stream management.

American Fisheries Society, Warmwater Fish. Div. Workshop on application of instream flow methodologies to warmwater fisheries. 1987. Tech Aqua Biol. Stn., TN. INVITED PAPER: Macroinvertebrate instream flow studies: needs and levels of precision.

American Fisheries Society, Warmwater Fish. Div. Workshop on application of instream flow methodologies to warmwater fisheries. 1987. Tech Aqua Biol. Stn., TN. Presented Paper: Problems in applying IFIM to warmwater river ecosystems.

U.S. Fish and Wildlife Service, National Conf. on Instream Flow and Restoration Techniques. 1988. Atlanta, GA. INVITED PAPER: Case history study of the application of IFIM techniques to river restoration.

North American Benthological Society. 1988. Tuscaloosa, AL. Presented Paper: Changes in larval chironomid habitat with distance from peaking hydropower operations.

Fourth International Symposium on Regulated Streams. 1988. Loughborough, England. INVITED KEYSTONE PAPER: Instream flow predictions and management options for biota affected by peaking-power hydroelectric operations.

Fourth International Symposium on Regulated Streams. 1988. Loughborough, England. Presented Paper: Benthic macroinvertebrate communities below a hydropower dam, Caney Fork River, Tennessee, USA.

Fourth International Symposium on Regulated Streams. 1988. Loughborough, England. Presented Paper: Seasonal variation in the composition of the drift below a peaking hydroelectric project.

Texas Instream Flow Workshop. 1988. San Marcos, TX. INVITED PAPER: Techniques and limitations of instream flow models for peaking hydropower impacts. [Invited as participant on National Expert Panel]

U.S. Environmental Protection Agency. National Symposium: Recovery of lotic ecosystems following disturbance: theory and application. 1988. Duluth, MN. INVITED PAPER: Island biogeographic and predicting lotic community recovery rates and pathways.

U.S. Environmental Protection Agency. National Symposium: Recovery of lotic ecosystems after disturbance: theory and application. 1988. Duluth, MN. INVITED PAPER: Summary and synthesis of research needs and application to EPA regulatory functions.

Freshwater Research Unit, University of Cape Town, South Africa. 1989. INVITED SEMINAR: Techniques for predicting minimum flow requirements in lotic ecosystems: application of the physical habitat simulation (PHABSIM).

Department of Water Affairs, Pretoria, South Africa. 1989. INVITED SEMINAR: A survey of instream flow techniques, the computer simulation PHABSIM, and possible applications to southern Africa rivers.

Institute for Freshwater Research/J.L.B. Smith Institute of Ichthyology/Department of Zoology, Rhodes University, Grahamstown, South Africa. 1989. INVITED SEMINARS: (1) Theory and field techniques in instream flow analysis. (2) Are lotic organisms adapted to flow?

North American Benthological Society. 1989. Guelph, Ontario. Presented Paper: Application of ecological theory to determining the recovery potential of disturbed lotic ecosystems: research needs and priorities.

Symposium on Water: Laws and Management. 1989. Cape Town, South Africa. INVITED PAPER: Case histories of instream flow assessments to meet U.S. regulatory requirements.

Zoology Department/University of Cape Town. 1989. Cape Town, South Africa. INVITED COLLOQUIUM: Are lotic organisms adapted to flow and what are the implications to ecological theory?

Department of Zoology/Department of Botany/Institute of Natural Resources, University of Natal, Pietermaritzburg, South Africa. 1989. INVITED SEMINAR: Development and application of minimum flows to riverine ecosystems.

American Fisheries Society. 1989. Ann. Mtg. Anchorage, AK. Presented Paper: Altering physical habitat simulations to account for responses of rainbow trout and banded sculpin to peaking hydroelectric discharges.

Fourth South African National Hydrological Symposium. 1989. Pretoria. Presented Paper: Application of the revised physical habitat simulation (PHABSIM II) to minimum flow evaluations of South African rivers.

Center for Field Biology. 1990. Third Annual Symposium, The Natural History of Lower Tennessee and Cumberland River Valleys. Land-Between-The-Lakes, TN. INVITED PAPER: The affect of varying flow rates on colonization rates and the ability to predict recovery from disturbance in lotic ecosystems.

Symposium on River and Stream Management. 1990. Indiana Dept. Env. Mgmt./Indiana Wildlife Society. Muncie, IN. INVITED PAPER: The role of instream flow studies in regulated river management.

North American Benthological Society. 1990. Blacksburg, VA. Presented Paper: *Hippopotamus amphibius*, a "benthic" indicator for flow-related habitat in southern Africa.

Wetlands Delineation Workshop (Tennessee Div. of Water Poll. Contr./US EPA) 1990. Tech Aqua Biol. Stn., TN. INVITED PAPER: An overview of stream restoration practices.

International Conference on the Conservation and Management of Rivers. 1990. Univ. of York, Peterborough, UK. Presented Paper: A non-traditional application of instream flow techniques for conserving habitat of biota in the Sabie River of southern Africa.

International Conference on the Conservation and Management of Rivers. 1990. Univ. of York, Peterborough, UK. Presented Paper: The use of instream flow techniques for evaluating freshwater mussel habitats and predicting flow-related loss of mussel beds.

University of New Orleans. Dept. of Biology. 1991. INVITED SEMINAR: Application of physical habitat models for conserving endangered aquatic fauna in southern Africa.

Louisiana Nature and Science Center. 1991. New Orleans, LA. THE ANNUAL FREEPORT-MCMORAN LECTURE: A biologist's view of South Africa.

North American Benthological Society. 1991. Santa Fe, NM. Presented Paper: Near-substrate hydraulic conditions under artificial flood conditions.

Hancock Biological Station. 1991. Murray, KY. Summer seminar series. INVITED SEMINAR: Conserving endangered aquatic biota in southern Africa through application of physical habitat models.

United States Environmental Protection Agency. National Workshop: Water Quality-Based Approach for Point Source and NPS Controls. 1991. Chicago, IL. INVITED PAPER: Application of tools for ecological restoration - predictive modeling.

Fifth International Symposium on Regulated Streams. 1991. Flathead Biological Station, MT. Presented Paper: Use of physical habitat models to predict relative abundances of biota downstream of multiple impoundments in the Buffalo River (eastern Cape Province), South Africa.

East Tennessee State University, Dept. of Biology. 1991. Johnson City, TN. INVITED SEMINAR: Application of habitat models in the management of endangered aquatic fauna of southern Africa.

Tennessee Tech University, Dept. of Biology. 1991. Cookeville, TN. INVITED SEMINAR: Application of habitat models for protecting endangered aquatic fauna in southern African rivers.

Seventh Annual Scientific Symposium of the Ohio River Basin Consortium. 1991. Murray State University, Murray, KY. Presented Paper: Special considerations in the development of predictions of ecological effects from modification of peaking hydropower operations.

North American Benthological Society. 1992. Louisville, KY. Presented Paper: Use of physical habitat models to predict relative abundances of benthos downstream of multiple impoundments in the Buffalo River (eastern Cape Province), South Africa.

Auburn University. Dept. of Biology/Coop. Fish. Res. Unit. 1992. Auburn, AL. INVITED SEMINAR: Southeastern streams and the hydrodynamics associated with macroinvertebrate populations; plus IFIM.

International Environmental Dredging Symposium. 1992. Buffalo, NY. INVITED PLENARY PAPER: Predicting enhancement and recovery times after placement of habitat structures for fish and benthos in erosional zones.

Phi Beta Kappa Symposium on Development and the Environment. 1992. Tulsa, OK. INVITED PAPER: Water resource management in southern Africa: ecosystem stability and human consumption.

Fifth Symposium on The Natural History of Lower Tennessee and Cumberland River Valleys. 1993. Land Between The Lakes, Tennessee. Presented Paper: Best management practices for improving water quality in the West Sandy Creek watershed, Henry County, Tennessee.

New Zealand Limnological Society. 1993. Wellington, New Zealand. INVITED SPECIAL WORKSHOP: Stream and River Restoration. [Conducted two days of 8-hour sessions].

National Institute of Water and Atmospheric Research. 1993. Hamilton, New Zealand. INVITED PAPER: Problems associated with the management of endangered species and river ecosystems in developing nations.

Riparian Habitat Protection and Reconstruction Workshop. 1993. Clarksville, TN. INVITED PAPER: Habitat enhancement using instream sediment control structures.

Ecological Society of America. 1993. Madison, WI. INVITED PAPER: Ecological considerations in the design of restoration projects on large rivers.

Association for Integrative Studies. 1993. Detroit, MI. Presented Paper: An approach to the development of interdisciplinary graduate programs in environmental analysis and management.

North American Benthological Society. 1994. Orlando, FL. INVITED PAPER: Using physical habitat models to aid in the design, placement and timing of instream habitat structures.

American Power Conference. 1994. Chicago, IL. INVITED PAPER: New methods for instream flow assessments related to hydropower development.

International Conference on Sustaining the Ecological Integrity of Large Floodplain Rivers. 1994. La Crosse, WI. INVITED PAPER: Managed floods on floodplain rivers: is hydraulic disturbance offset by ecological benefit?

Sixth International Symposium on Regulated Streams (SISORS II). 1994. Ceske Budejovice, Czech Republic. Presented Paper: Habitat partitioning among co-existing darter species (Percidae) in parallel catchments. Implications for instream flow analysis using target fish species.

Sixth International Symposium on Regulated Streams (SISORS II). 1994. Ceske Budejovice, Czech Republic. Presented Paper: Disturbance risk as a measure of habitat suitability for benthos below a peaking hydropower project.

First IAHR Symposium on Habitat Hydraulics. 1994. Trondheim, Norway. Presented Paper: Combining colonization rates and hydraulic criteria for prediction of restoration success in streams and rivers.

Symposium on Aquatic Habitat Restoration in Northern Ecosystems. 1994. Girdwood, AK.
INVITED PAPER: The science of restoration: facts and fiction.

Symposium on Aquatic Habitat Restoration in Northern Ecosystems. 1994. Girdwood, AK.
INVITED PAPER: Applying island biogeographic theory to river and stream restoration.

North American Benthological Society. 1995. Keystone, CO. INVITED PAPER: The use of benthic macroinvertebrate community diversity as a "target species" in instream flow assessments. (invited as organizer/chair of Technical Information Workshop on applications of benthos in instream flow studies)

Symposium on Water Quality: Freshwater Quality: Defining the Indefinable? 1995. Stirling, UK. INVITED PLENARY PAPER: Current interpretations of the term 'freshwater quality': a non-European perspective.

Symposium on Remedial Strategies in Regulated Rivers. 1995. Lycksele, Sweden.
INVITED PLENARY PAPER: Flow-related habitat requirements as a component of remediation in regulated rivers.

North American Benthological Society. 1996. Kalispell, MT. Presented Paper: Longitudinal shifts in high quality macroinvertebrate habitat as flows fluctuate across an artificial riffle.

Ecohydraulics 2000. 1996. Quebec City, Quebec. Presented Paper: An analysis of artificial riffles and enhancement of benthic community diversity by Physical Habitat Simulation (PHABSIM) and direct observation.

American Water Resources Association. 1996. Syracuse, New York. INVITED KEYNOTE PAPER: Blending biological and physical considerations in riverine restorations.

Workshop on Instream Flow Assessments. 1997: T.G. Masaryk Institute of Hydrology; Prague, Czech Republic. INVITED PRESENTATION: Field analysis and PHABSIM application of macroinvertebrate habitat suitability criteria.

Seventh International Symposium on Regulated Streams (SISORS III). 1997. Chattanooga, TN. Presented Paper: Macroinvertebrates in instream flow studies: What are the appropriate targets for management?

Cooperative Research Center for Freshwater Ecology, Albury, NSW Australia. 1998.
INVITED WORKSHOP (full day): The future of stream and river rehabilitation and restoration.

Department of Biology, Monash University, Caulfield East, VIC Australia. 1998. INVITED WORKSHOP (full day): The future of stream and river rehabilitation and restoration.

North American Benthological Society. 1998. Prince Edward Island, Canada. INVITED PRESENTATION: Large River Restoration: Lessons yet to be learned.

Georgia Chapter, American Fisheries Society. 1999. Tifton, GA. INVITED PRESENTATION: Is there value in using benthic macroinvertebrates in in-stream flow decisions

19th Annual Symposium on Sea Turtle Biology and Conservation. 1999. South Padre Island, TX. Presented Paper: Early post-nesting movements of loggerhead turtles (*Caretta caretta*) on the southwest coast of Florida.

International Conference on Modeling for the Twenty-First Century, Predicting Plant and Animal Occurrences: Issues of Scale and Accuracy. 1999. Snowbird, UT. INVITED PAPER: Macroinvertebrates in instream flow management: issues of density, diversity, and taxonomic scale.

WERF Workshop to Develop Research Framework to Assess Ecosystem Effects Relative to the Scale and Dynamics of Large River System. 1999. Chicago, IL. INVITED PAPER: Summary report: US EPA Large Rivers Science Advisors workshop in Baltimore.

Eighth International Symposium on Regulated Streams. 2000. Toulouse, France. INVITED PAPER: Macroinvertebrate instream flow studies after 20 years: a role in stream and river restoration.

North American Benthological Society. 2001. LaCrosse, WI. Using GIS and landuse data to select candidate reference sites for stream bioassessment.

North American Benthological Society. 2001. LaCrosse, WI. Macroinvertebrate bioassessment detects the impacts of three years of drought in the catchment of the middle Chattahoochee River.

Atlanta Consortium for Research in the Earth Sciences. 2001. Atlanta, Ga. INVITED LECTURE: Ecohydrological models for use in regulated river management and stream restoration.

Murray-Darling Freshwater Research Center. 2001. Albury, NSW, Australia. INVITED LECTURE: Instream flows, politics, and engineers?

Water Environment Federation. WEFTEC. 2001. Atlanta, GA. WERF: Technology and Watershed Assessment: Application to Reasonable Assurance Determinations in Columbus, Georgia. Presented Paper: Macroinvertebrates survey and biotic indices.

SEMP Ecosystem Management Program. 2001. Columbus, GA. INVITED LECTURE: The Georgia Ecoregions Project.

Gas Technology Institute. GTI's 14th International Conference on Site Remediation Technologies & Environmental Management in the Utility Industry. 2001. Orlando, FL. Presented Paper: Recovery and structure of benthic and fish communities after habitat rehabilitation: Athens, Georgia, MGP excavations.

International Association for Sediment Water Science (IASWS) Ninth International Symposium, Banff, CANADA. 2002. Recovery and structure of aquatic communities after MGP sediment remediation and habitat rehabilitation.

North American Benthological Society. 2002. Pittsburgh, PA. Presented Paper: Recovery and structure of benthic communities after MGP sediment remediation and habitat rehabilitation.

9th International Petroleum Environmental Conference. 2002. Albuquerque, NM. INVITED PAPER: Analysis of habitat loss for target biota in rivers impacted by long-term flow increases resulting from CBM production in the Powder River basin.

Georgia Water & Pollution Control Association. 2002. Dalton, GA. INVITED PAPER: The Georgia Ecoregions Project: Assessing nonpoint source impacts in reference and impaired streams.

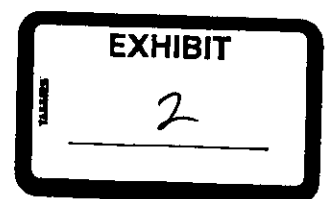
Instream Flow Science and Management in Western Washington: Developing a Comprehensive, Ecosystem-Based Approach. 2003. Seattle, WA. INVITED PAPER: Effects of streamflows on aquatic and riparian biota (excluding salmonids).

Southeast Chapter, Society for Environmental Toxicology and Chemistry. 2003. Columbus, GA. KEYNOTE TALK. The Georgia Ecoregions Project - Assessing Stream Ecosystem Integrity from NPS Pollution: Is there a linkage to TMDL's?

Ninth International Conference on River Research and Applications. 2003. Albury, NSW, Australia. Presented Paper: Recovery and colonization dynamics of macroinvertebrates and fish in newly created habitat after sediment remediation from manufactured gas processing waste in the Oconee River, Georgia, USA.

Colloquium Series. 2003. University of South Florida St. Petersburg. Environmental Science, Policy, and Geography. INVITED SPEAKER: Minimum flow assessments in central Florida Rivers: first attempts and new considerations.

10th International Petroleum Environmental Conference. 2003. Houston, TX. INVITED PAPER: Potential habitat loss and population bottlenecks created by increased flows from CBM operation."



Analysis of Habitat Loss for Target Biota in Rivers Impacted by Long-Term Flow Increases from CBM Production

James A. Gore, PhD, Professor and Chair, Dept. of Environmental Science and Public Health,
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ABSTRACT

A primary concern in the evaluation of impairment to lotic ecosystems is the potential disruption of the integrity of riverine communities when flows are enhanced by surficial releases resulting from CBM production. Regional hydrogeologists have predicted daily increases in flows of 20% to 80% over the period of production. I analyzed the potential impact of this flow increase utilizing the Physical Habitat Simulation (PHABSIM). The PHABSIM protocol ties hydrologic information (stage/discharge relationships and measured information on velocity, depth, and substrate) at typical stream reaches with biological information (habitat suitability) to predict changes in the amounts and locations of available habitat over a range of discharges. The analysis is completed with a time-series analysis of a yearly daily hydrograph of the stream to determine which time intervals contain long-duration low-habitat periods. These intervals are considered to be "bottlenecks" in the success of the population or communities. The analysis was based upon data sets from Crazy Woman Creek, near Arvada, Wyoming, the Lower Powder River near Weston, Wyoming, the Powder River at Arvada, Wyoming, the Belle Fourche River below Moorcroft, Wyoming, and the Tongue River, near Stateline, Montana. Habitat evaluations were performed sauger (*Stizostedion canadense*), shovelnose sturgeon (*Staphirhynchus platyrhynchus*), and adults of the endangered western silvery minnow (*Hybognathus argyritis*) as well as for benthic macroinvertebrates. Greatest habitat losses, with bottlenecks ranging from 40% to 65% for more than 28 consecutive days, were seen at all locations for the western silvery minnow and for macroinvertebrates. It is likely that losses in the richest habitat patches under high flows could be well over 75% during prolonged periods of high flow, especially shallow bypass channels and shoals. These "bottlenecks" in production and/or population success could lead to the demise of those species in the community and the destabilization of community structure and ecosystem integrity.

INTRODUCTION

Traditionally, instream flow analysis has been utilized, as a management tool, to reserve minimum flows for water withdrawal or diversion permits. These techniques have rarely been used to determine or predict the impacts of the augmentation of flows in a river channel. Although small, there is a body of literature to suggest that the increase in flows can have a detrimental impact on riverine biota, just as the reduction in flows has been demonstrated to do.

In examining the potential impacts of the uprating or upgrading of hydropower turbines in the Cumberland and Tennessee River systems, over 80% of available foraging, spawning, and maintenance habitat were lost to benthic macroinvertebrates, as well as all of the life stages of many fish species (1,2,3,4). These studies reported the impacts of peaking hydropower events, in which the water surface elevation increased two or more meters while average discharges increased from 25 m³/s to over 300 m³/s for periods of two to five hours. In all of these cases, the increased flows sufficiently altered the available hydraulic habitat (combinations of velocity, depth, and substrate) to make significant numbers of habitat patches unusable for foraging, resting, refuge, or spawning. These periods of low or no availability occurred at irregular intervals and the authors were unable to predict what the ultimate outcome of this short-term loss of habitat might be. Although these studies were designed to examine just the impact of increased flows on physical habitat, Moog (5) determined that even short bursts of increased flows over a long period of time, flushed non-adaptive organisms out of the system, depleted particulate organic matter, and sufficiently altered channel morphology to alter substrate composition by increased sedimentation. The depletion of macroinvertebrates ultimately led to the decline of fish populations, as well. This relatively small body of research does suggest that there is a potential impact from increasing flows to an ecosystem. With the potential development of large-scale coal-bed methane (CBM) generation in the Powder and Tongue River basins of Montana and Wyoming, there exists the possibility that long-term increases in both water surface elevation and discharge and their concomitant alterations of hydraulic habitat can result in significant changes in available habitat and the ultimate success of individual populations or communities in the rivers and streams of these basins.

In this paper, I provide preliminary analysis of some of the river basins in the Powder River Basin oil and gas project (*Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project (WY-070-02-065)*) (DEIS) and the probable impacts of increasing flows. Although there continues to be considerable debate as to the amount of return water from the proposed CBM operations, the draft EIS acknowledges that increased flows of one magnitude or another will be created. Since the CBM operations are scheduled to be in continuous operation for more than 20 years, it is imperative that the potential for loss of habitat and subsequent loss of community or population integrity be examined, especially for those species endemic to the region or designated as threatened or endangered species.

METHODS

The analysis of potential impacts was accomplished through utilization of the Physical Habitat Simulation (PHABSIM), widely employed by the U.S. Geological Survey, the U.S. Fish and Wildlife Service, and the Federal Energy Regulatory Commission for the assessment of altered flows in river ecosystems.

The Physical Habitat Simulation (PHABSIM)

The PHABSIM model [the evaluation tool within the Instream Flow Incremental Methodology (IFIM) (6)] combines hydrologic records (from gauging stations along the river), direct measurements of conditions at the site, and biological information on the flow-related habitat requirements of various aquatic species. ~~The output of the model is a prediction of the gains and/or losses of habitat with changes in discharge or with a proposed regulated flow regime.~~ PHABSIM and IFIM are widely accepted as a basis for establishing acceptable flows to maintain the integrity of stream and river ecosystems (6,7). The PHABSIM protocol ties hydrologic information (stage/discharge relationships and measured information on velocity, depth, and substrate) at typical stream reaches with biological information (habitat suitability) to predict ~~changes in the amounts and locations of available habitat~~ over a range of discharges (a schematic of the process is provided in Figure 1). The relationship between discharge and available habitat (expressed as weighted usable area (WUA)) is the output used to determine optimal and minimum flow conditions for the target organism. The circle in the WUA/Discharge plot (Figure 1), indicates the discharge at which 15% of the habitat is lost from optimal conditions. In general, instream flow analysts consider a loss of more than 15% habitat, as compared to undisturbed or current conditions, to be a significant impact on that population or assemblage (8). The analysis is completed with a time-series analysis of a yearly daily hydrograph of the stream to determine which time intervals contain long-duration low-flow periods. These are considered to be "bottlenecks" in the success of the population are management targets. In a similar manner, we ~~used PHABSIM to analyze the duration and intensity of poor-habitat-producing high-flow events in selected basins of the Powder River CBM project area.~~

Powder River Basin Data

As would be typical of an analysis of impacts of discharge changes upon available habitat, a series of transects across riffles, runs and pools (a typical hydrologic stream unit) should be measured at low, medium and high flows for calibration of the velocity and depth segments of the hydrologic component of the model. Additionally, development of habitat suitability criteria for endemic and unique species, endangered or special concern species, and keystone community species or guilds must be supplied for this evaluation. ~~Since this had not been accomplished for the DEIS, I chose to use the only transect data previously published.~~ These data were measured to establish a gauging record and stations (USGS 06316400) at Crazy woman Creek at Upper station, near Arvada, Wyoming, (USGS 06324970) at the Lower Powder River about Dry Creek near Weston, Wyoming, (USGS 06317000) at the Powder River at Arvada, Wyoming, and (USGS 06426500) at the Belle Fourche River below Moorcroft, Wyoming. These single transects were most representative of deep run and pool transects, thus representing only a small portion of available habitat. The data I analyzed then are only ~~representative of impacts to a single type of habitat.~~ However, these are also the habitat types least impacted by flow alterations (8,9). Thus, our conclusions should be viewed as an extremely conservative view of the potential impact of increased flows from CBM development in the Powder River basin.

This type of analysis, as a preliminary analysis of potential impacts of altered flow regime, when more extensive field data collections are unavailable, ~~has been accepted by the courts in similar analyses~~ (see: Upper Chattahoochee Riverkeeper vs. Harold Reheis, Director; Environmental Protection Division; Department of Natural Resources (respondent) and Georgia

Power Company (intervenor): Case OSAH-DNR-WW-01-74-MM [State of Georgia, Administrative Hearing]).

Habitat evaluations were performed for all life stages of sauger (*Stizostedion canadense*), shovelnose sturgeon (*Staphirhynchus platyrhynchus*), and adults of the western silvery minnow (*Hybognathus argyritis*). Additionally, habitat conditions to support highest benthic macroinvertebrate diversity were evaluated. Gore *et al.* (10) have demonstrated that benthic macroinvertebrates often have more narrow hydraulic habitat tolerances than similar habitat dwellers, such as sculpin or darters. Indeed, macroinvertebrate communities will lose (or gain) significantly greater amounts of habitat over comparable ranges of discharge. ~~Since macroinvertebrates represent the critical energy link between primary production and the forage and game fish, it is imperative that habitat integrity for such organisms as aquatic insects be considered.~~ All habitat criteria were provided as standard recommended data by the U.S. Fish and Wildlife Service or the U.S. Geological Survey (11,12) or modified as appropriate to the biological circumstances (with consultation with the authors), state agencies (13) or, in the case of macroinvertebrate data, have been previously published and used in habitat evaluations and flow negotiations in the United States (10).

RESULTS

For ~~Crazy Woman Creek~~, simulations of habitat availability over a discharge range of 0 to 462.2 cubic feet per second (cfs) (0 to 13.09 m³/s) were created (Figure 2). Shovelnose sturgeon adults and spawning requirements lost significant habitat at discharges less than approximately 75 cfs (2.12 m³/s) while fry and juvenile stages lost habitat at discharges less than 50 cfs (1.42 m³/s) and at discharges greater than 250 cfs (7.08 m³/s). There was no available habitat for sauger adults and spawning at any discharge, while habitat losses occurred for fry and juveniles at discharges less than 40 cfs (1.13 m³/s) and more than 175 cfs (4.96 m³/s). The most significant biota to be impacted by flow alterations on Crazy Woman creek were western silvery minnow adults which lost significant habitat at discharges less than 0.05 cfs (0.001 m³/s) and greater than 24.5 cfs (0.69 m³/s). Macroinvertebrate community diversity was similarly affected. There were substantive losses of habitat at discharges less than 12 cfs (0.34 m³/s) and greater than 50 cfs (1.42 m³/s) as well.

For the Little Powder River, simulations of habitat availability over a discharge range of 0 to 622 cubic feet per second (cfs) (0 to 17.62 m³/s) were created (Figure 3). Shovelnose sturgeon adults and spawning requirements lost significant habitat at discharges less than approximately 75 cfs (2.12 m³/s) while fry and juveniles stages lose habitat at discharges less than 50 cfs (1.42 m³/s) and at discharges greater than 162 and 237 cfs (4.59 and 6.72 m³/s), respectively. There was essentially no available habitat for sauger adults and spawning at any discharge, while habitat losses occurred for fry and juveniles at discharges less than 10 cfs (0.28 m³/s) and more than 15 cfs (0.42 m³/s) for fry and more than 175 cfs (4.96 m³/s) for juveniles. The most significant biota to be impacted by flow alterations on the Little Powder River were western silvery minnow adults which lost significant habitat at discharges less than 0.05 cfs (0.001 m³/s) and greater than 0.5 cfs (0.01 m³/s). Macroinvertebrate community diversity was similarly affected. Discharges less than 0.2 cfs (0.006 m³/s) and greater than 0.5 cfs (0.014 m³/s) also resulted in substantive losses of habitat.

For the Powder River, simulations of habitat availability over a discharge range of 0 to 9172 cubic feet per second (cfs) (0 to 259.72 m³/s) were created (Figure 4). Shovelnose sturgeon adults and spawning requirements lost significant habitat at discharges less than approximately 75 cfs (2.12 m³/s) and greater than 2000 cfs (56.63 m³/s) while fry and juveniles stages lost habitat at

discharges less than 616 cfs ($17.44 \text{ m}^3/\text{s}$) and at discharges greater than 977 and 1338 cfs ($27.67 \text{ m}^3/\text{s}$ and $37.89 \text{ m}^3/\text{s}$), respectively. There was essentially no available habitat for sauger spawning while adults lost significant habitat below 200 cfs ($5.66 \text{ m}^3/\text{s}$) and at discharges greater than 400 cfs ($11.33 \text{ m}^3/\text{s}$). Habitat losses occurred for fry and juveniles at discharges less than 0.05 cfs ($0.014 \text{ m}^3/\text{s}$) and more than 125 cfs ($3.54 \text{ m}^3/\text{s}$). Again, the most significant biota to be impacted by flow alterations on the Powder River were western silvery minnow adults which lost significant habitat at discharges less than 0.05 cfs ($0.014 \text{ m}^3/\text{s}$) and greater than 125 cfs ($3.54 \text{ m}^3/\text{s}$). Macroinvertebrate community diversity is similarly affected. At discharges less than 0.05 cfs ($0.014 \text{ m}^3/\text{s}$) and greater than 125 cfs ($3.54 \text{ m}^3/\text{s}$), substantive losses of habitat also result.

For the ~~Belle Fourche River~~, simulations of habitat availability over a discharge range of 0 to 228.2 cubic feet per second (cfs) ($6.46 \text{ m}^3/\text{s}$) were created (Figure 5). Shovelnose sturgeon adults and spawning requirements were satisfied through the entire range of discharges examined. Indeed, this appears to be one of those instances in which the addition of water increased available habitat for all life stages. Unfortunately, those same discharge increases resulted in the loss of habitat for other target species. There was essentially no available habitat for sauger fry while available habitat for other life stages was minimal. Again, the most significant biota to be impacted by flow alterations on the Belle Fourche River were western silvery minnow adults which lost significant habitat at discharges less than 12 cfs ($0.34 \text{ m}^3/\text{s}$) and greater than 30 cfs ($0.85 \text{ m}^3/\text{s}$). Macroinvertebrate community diversity was similarly affected. Discharges less than 16 cfs ($0.45 \text{ m}^3/\text{s}$) and greater than 30 cfs ($0.85 \text{ m}^3/\text{s}$) also produced substantive losses of habitat.

DISCUSSION

At first glance, one might assume that, in most cases, the discharges of concern, both at the high and low ends, are rarely exceeded. Thus, it becomes important to understand and predict the duration and intensity of these "poor habitat" periods in order to assess the potential risk to the target populations. That is, the decision-makers must decide what percentage of the time a selected flow is met or exceeded during an average hydrograph and during unusually wet or dry years. This is accomplished through the Habitat Time Series (HTS) component of IFIM (14). Such conditions as median habitat value over ten or twenty years of record, the percentage of available habitat if certain magnitudes of flood were attenuated or enhanced, and the duration of low habitat conditions are typical predictions of a HTS evaluation. With the output generated by this study, such an evaluation is premature since several habitat types were not evaluated. However, it is still possible to make observations about the expected habitat-bottleneck periods during a "typical" water year.

The DEIS estimates that less than 20% of the water used in the CBM process will ultimately reach surface flows in the local rivers and streams; the remainder of the water either evaporating or returning directly to groundwater. This seems unlikely at certain times of the year (especially winter months) when evaporative loss and transpirational loss from vegetation will be close to zero [see, for example, Rankl and Lowry (15), who estimated that more water moves laterally through the alluvium rather than being lost to infiltration]. Rankl and Lowry's work on the Powder River Basin is based on data collected over all months and seasons for several years rather than during the lowest water month, October, when infiltration rates were not typical of the region for the rest of the year and when the single stormwater event that was analyzed would appear to produce the desirable results presented in the DEIS. Indeed, with continuous inputs of water, many ephemeral streams are likely to be transformed into perennial streams. This will result in increases in bank storage and elevation of water tables, slowing infiltration and resulting

in even higher lateral flows into the rivers and streams of the basins. This conclusion is supported by at least on current piece of research in the region. During 2001 and 2002, for example, Burger Draw and Sue Draw were still flowing in January and there was very little loss between discharge points and the Powder River (Larry Munn and Quentin Skinner, University of Wyoming; personal communication); the conveyance loss being only a few percent rather than the 80% predicted by the DEIS.

To examine the annual impact of CBM production on various rivers and streams in the Powder River basin, I chose to examine daily habitat gains or losses based upon scenarios which envision the amount of water that would be added to the system if there were 60%, 40% and 20% of water in the CBM process (scenarios provided by John Monks, Hydro-Geosciences, Redmond, WA) (Table 1-3). I have used mean daily flow hydrographs for the period of record at each USGS site and added the conveyance scenarios (in percentages) in order to determine what might be the daily losses of habitat, when compared to existing conditions, for the target species of record. Since it does not appear that sauger and shovelnose sturgeon will be heavily impacted, I have focused upon the western silvery minnow and macroinvertebrates. The average annual gain or losses in habitat for these target species are displayed in Tables 4 and 5.

Under these three scenarios, the western silvery minnow and benthic macroinvertebrates ~~will suffer significant losses of habitat for forage and maintenance during significant portions of the year.~~ Even though there may appear to be a relatively small net loss in habitat over the year, there are significant daily losses of habitat of over 15%. In some cases these habitat losses occur over 33% of the year and as much as 50% of the year. Of greater significance is the duration of some of these habitat-loss periods that last for over two months and may represent losses as high as 45% or more of available habitat. Indeed, there are longer periods of habitat loss broken by single days of adequate habitat. For example, on Crazy Woman Creek, there is one time period of 32 consecutive days of significant habitat loss for western silvery minnow, but one span of 82 days in which 78 days contain significant habitat losses (Figure 6). On the Belle Fourche River, benthic macroinvertebrates suffer the same conditions for 56 consecutive days, broken by a single day in which habitat loss is about 10% (Figure 7). The intervening single day events of adequate habitat likely would result in further losses of individuals of the western silvery minnow or macroinvertebrates as they move into temporarily available habitat and are, on the following day, excluded from these habitats and, perhaps, left without adequate corridors to get to patches of acceptable habitat. Even when these habitat losses occur as additions to predictable flood events, this habitat loss is reflected as inability to access hydraulic refuge, which could result in the flushing of these organisms out of the system. Several studies have indicated that habitat losses like these can be directly correlated with loss in numbers of individuals (i.e., secondary production) and in diversity (16, 17, 18, 19). Losses in diversity have the effect of simplifying community structure, making them more susceptible to additional disturbance (natural or anthropogenic) and losses of individuals (especially if fry or juveniles) can result in the creation of population bottlenecks, ultimately leading to the decline and/or extirpation of that population from the basin or similar reaches. ~~Although there are always natural habitat bottlenecks during a water year,~~ these occur quite predictably (spring run-off, for example) and most species are adapted to these predictable periods of reduced spawning and maintenance habitat. Refuge habitat becomes important during these time periods but must be maintained. Habitat loss at intervals other than the usual time periods can result in significant losses to production and population success. This suggests that the proposed operating scenario of continuous additions of water to the rivers in the project area will significantly impact instream communities. At a minimum, it seems that alternative CBM operating scenarios (than continuous production) must be proposed in which water will not be conveyed to rivers and streams in the project area during times of potential critical habitat loss. **This may mean cessation or reduction of operations during these time periods in order to reduce or eliminate habitat loss.**

These simulations of habitat conditions in the Powder River Basin demonstrate significant losses of habitat for a variety of typical riverine biota during periods of high flow as a result of the proposed CBM project. These habitat losses often have durations of over 30 days and have the potential to result in loss of productivity and diversity of benthic communities and forage fish. Ultimately, these losses, regardless of the availability of adequate habitat for other fish species, will likely result in the loss of fish populations because of the loss of the food base. These are significant losses to the lotic communities in these rivers and suggests a re-evaluation of the DEIS.

Although this is a preliminary analysis and only represents examination of the hydraulic habitat available for a single transect, the amount of habitat lost or gained in this, the least supportive, habitat type suggests even more significant habitat loss in more productive habitat patches. As in any river system, the greatest proportion of macroinvertebrate production, foraging by adult fish, and nursery support for juveniles and fry are in shallow areas with large amounts of cover, especially snags and undercut banks. Although greater than 25% of the habitat area in a typical reach consists of this habitat type, none of these transects could be evaluated in this analysis of the Powder River Basin. Since instream flow and minimum flow evaluations should focus upon the impacts to those areas first impacted by high flows, that is, riffles and runs, it is more likely than not that the greatest habitat losses are not occurring at the transects we evaluated but instead have yet to be analyzed. Since losses of over 50% of habitat are predicted by PHABSIM in the pool and deep run habitats, losses of comparable habitat in shallower transects will be significantly greater. It is likely that habitat losses under high flows could be well over 75% during prolonged periods of high flow, especially shallow bypass channels and shoals.

A great number of prairie macroinvertebrates and fish are uniquely adapted to the prairie stream environment. None of these species have been adequately studied for life-cycle habitat or for description of physical habitat requirements. However, since these species have evolved under the influence of a very different hydrograph than that which will be encountered over the next few decades of CBM operation, these species may be the most likely losses from the community.

It appears that any proposal for CBM operation in a prairie environment similar to the Powder River basin must effectively evaluate the amounts of water that will be conveyed as surficial flow to adjacent streams and rivers and the subsequent impacts of these flows on available habitat for the biota. This will mean a more comprehensive examination of lateral flows during all seasons of the year and a comparable effort to describe hydraulic habitat in all major habitat types. With this information a proper time-series analysis will further elucidate the time and duration of habitat bottlenecks for target biota. Since these bottlenecks in production and/or population success could lead to the demise of those species in the community and the destabilization of community structure and ecosystem integrity, it is imperative that such an evaluation be accomplished before the final authorization for CBM production is completed.

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Table 1. Predicted changes in annual hydrograph over the first 5 years of CBM operation [using projected amount of water produced from CBM wells under alternatives 1, 2A, and 2B in the DEIS] assuming that approximately 60% of surface discharge and infiltration impoundment recharges groundwater, remainder stays in shallow aquifer system, eventually discharging to surface waters (John Monks, Hydro-Geosciences, personal communication).

Calculated % of CBM component to mean annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	11.69%	17.39%	21.42%	23.77%	25.45%
Little Powder River	24.74%	23.43%	22.99%	22.38%	20.18%
Upper Powder River	10.79%	13.40%	14.98%	15.86%	16.38%
Belle Fourche River	38.42%	36.13%	34.52%	33.38%	32.43%

Calculated % of CBM component to minimum annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	56.67%	84.28%	103.79%	115.81%	123.34%
Little Powder River	377.76%	357.73%	350.94%	341.67%	308.11%
Upper Powder River	33.56%	41.65%	46.55%	49.29%	50.91%
Belle Fourche River	859.31%	808.05%	772.00%	746.50%	725.22%

Table 2. Predicted changes in annual hydrograph over the first 5 years of CBM operation [using projected amount of water produced from CBM wells under alternatives 1, 2A, and 2B in the DEIS] assuming that approximately 40% of surface discharge and infiltration impoundment recharges groundwater, remainder stays in shallow aquifer system, eventually discharging to surface waters (John Monks, Hydro-Geosciences; personal communication).

Calculated % of CBM component to mean annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	16.93%	25.18%	31.01%	34.41%	36.85%
Little Powder River	38.00%	35.99%	35.30%	34.37%	30.99%
Upper Powder River	20.27%	25.16%	28.13%	29.78%	30.76%
Belle Fourche River	83.47%	78.49%	74.99%	72.52%	70.45%

Calculated % of CBM component to minimum annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	82.05%	122.02%	150.26%	166.75%	178.57%
Little Powder River	580.13%	549.38%	538.94%	524.71%	473.16%
Upper Powder River	63.02%	78.21%	87.43%	92.56%	95.62%
Belle Fourche River	1866.78%	1755.42%	1677.11%	1621.70%	1575.48%

Table 3. Predicted changes in annual hydrograph over the first 5 years of CBM operation [using projected amount of water produced from CBM wells under alternatives 1, 2A, and 2B in the DEIS] assuming that approximately 20% of surface discharge and infiltration impoundment recharges groundwater, remainder stays in shallow aquifer system, eventually discharging to surface waters (John Monks, Hydro-Geosciences; personal communication).

Calculated % of CBM component to mean annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	22.17%	32.97%	40.60%	45.05%	48.24%
Little Powder River	51.26%	48.54%	47.62%	46.36%	41.80%
Upper Powder River	29.75%	36.93%	41.28%	43.70%	45.14%
Belle Fourche River	128.52%	120.86%	115.47%	111.65%	108.47%

Calculated % of CBM component to minimum annual flow

Watershed	2002	2003	2004	2005	2006
Crazy Woman Creek	107.43%	159.76%	196.73%	218.32%	233.80%
Little Powder River	782.50%	741.02%	726.94%	707.74%	638.22%
Upper Powder River	92.48%	114.78%	128.31%	135.84%	140.33%
Belle Fourche River	2874.26%	2702.80%	2582.22%	2496.90%	2425.73%

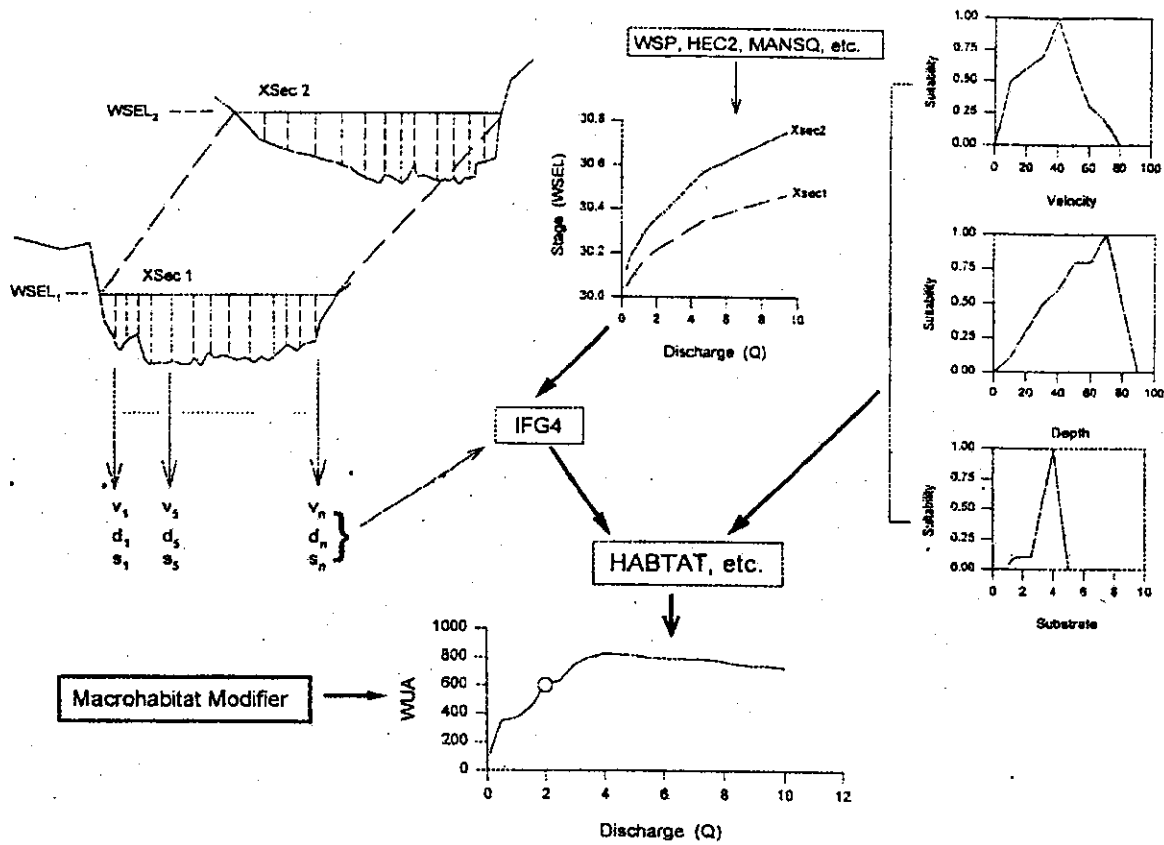
Table 4. Projected habitat gains or losses for Western Silvery Minnow.

	60% Scenario	40% Scenario	20% Scenario
Annual Habitat Gain/Loss			
Crazy Woman Creek	-2%	-3%	-4%
Little Powder River	-13%	-19%	-13%
Powder River	-6%	-12%	-17%
Belle Fourche River	0.5%	-1%	-4%
Total Number of Days of Significant Habitat Loss (>15%)			
Crazy Woman Creek	60	96	133
Little Powder River	97	124	92
Powder River	51	120	188
Belle Fourche River	112	144	156
Duration (days) of Continuous Significant Habitat Loss			
Crazy Woman Creek	14	17	32
Little Powder River	14	20	14
Powder River	33	46	70
Belle Fourche River	37	68	70
Average Habitat Loss During Long-duration Habitat Loss			
Crazy Woman Creek	-21%	-28%	-27%
Little Powder River	-41%	-54%	-43%
Powder River	-23%	-34%	-21%
Belle Fourche River	-35%	-50%	-64%

Table 4. Projected habitat gains or losses for Benthic Macroinvertebrates

	60% Scenario	40% Scenario	20% Scenario
Annual Habitat Gain/Loss			
Crazy Woman Creek	1.1%	2%	2%
Little Powder River	-11.7%	-17%	-11%
Powder River	-4.1%	-8%	-8%
Belle Fourche River	1%	-1%	-1%
Total Number of Days of Significant Habitat Loss (>15%)			
Crazy Woman Creek	11	21	50
Little Powder River	91	117	140
Powder River	36	56	98
Belle Fourche River	100	134	169
Duration (days) of Continuous Significant Habitat Loss			
Crazy Woman Creek	6	7	14
Little Powder River	14	19	23
Powder River	33	49	59
Belle Fourche River	15	21	71
Average Habitat Loss During Long-duration Habitat Loss			
Crazy Woman Creek	-22%	-19%	-25%
Little Powder River	-43%	-56%	-35%
Powder River	-29%	-41%	-21%
Belle Fourche River	-27%	-31%	-46%

Figure 1. Schematic diagram of the flow of data in the Physical Habitat Simulation (PHABSIM). Adapted from Gore and Mead (8).



Crazy Woman Creek -- Species of Concern

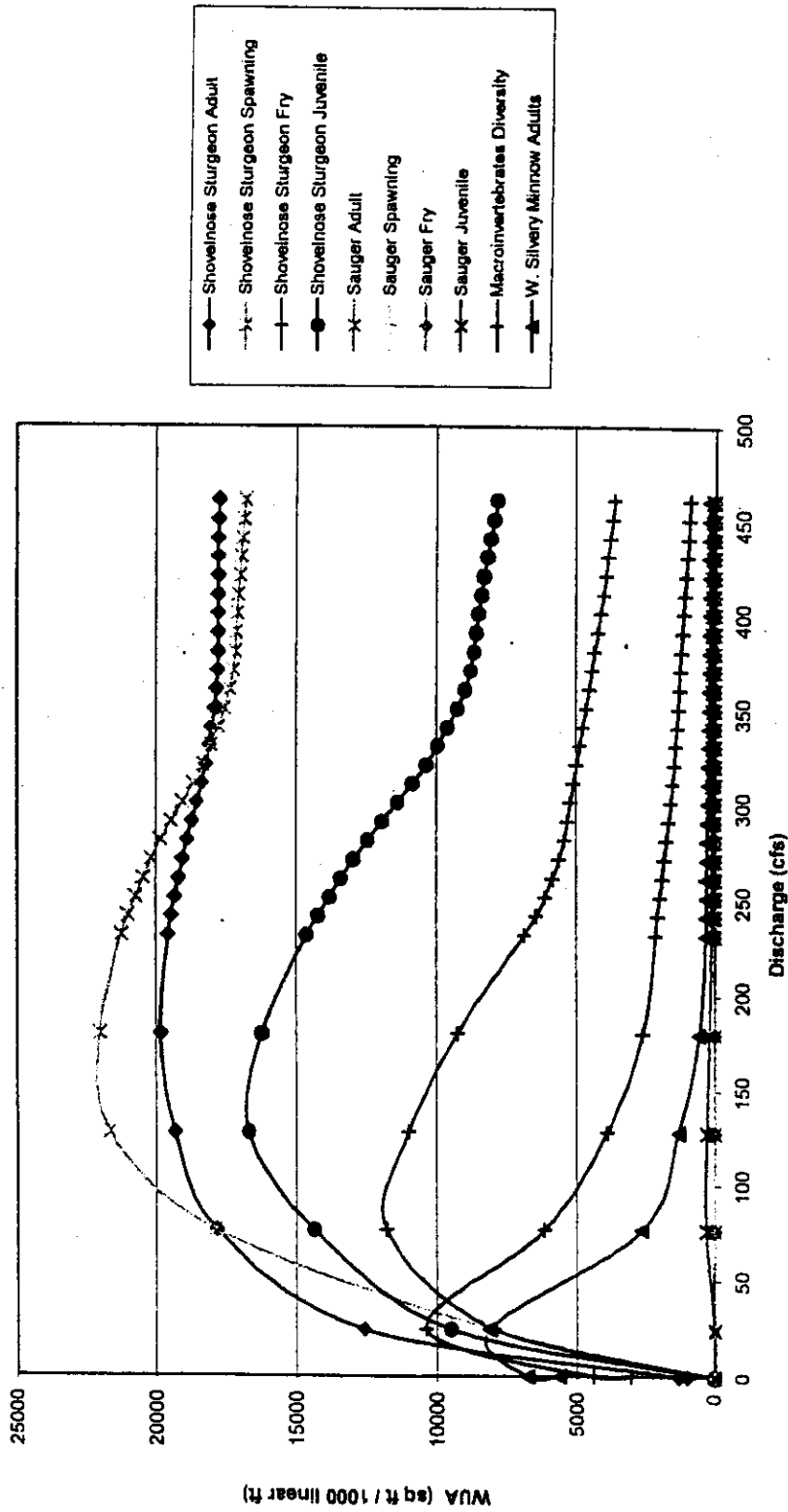


Figure 2. Predicted habitat gain/loss (WUA) as a function of discharge on Crazy Woman Creek. Discharge is in cubic feet per second (cfs) (where 35.3 cfs = 1 m³/s).

Little Powder River -- Species of Concern

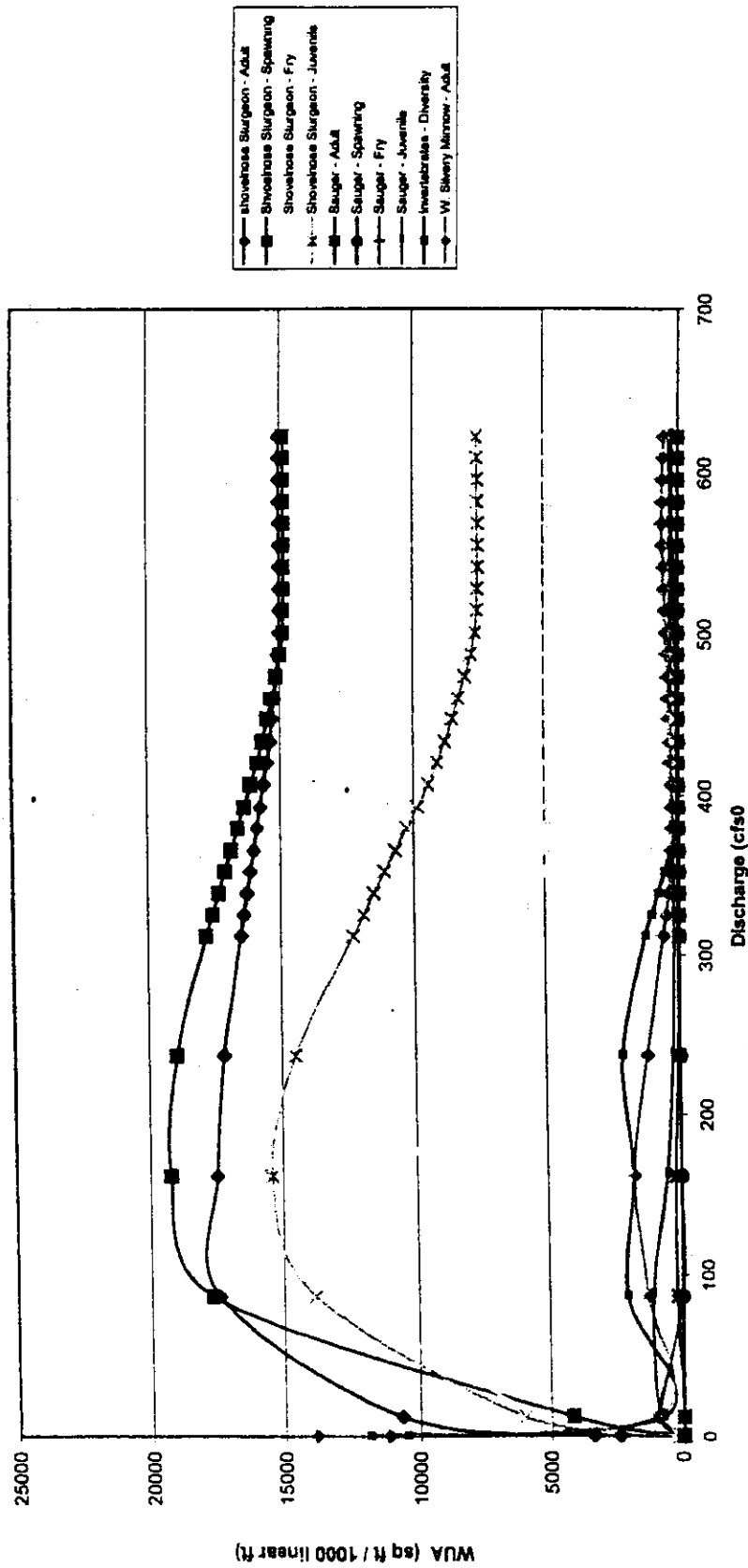


Figure 3. Predicted habitat gain/loss (WUA) as a function of discharge on the Little Powder River. Discharge is in cubic feet per second (cfs) (where 35.3 cfs = 1 m³/s).

Powder River - Species of Concern

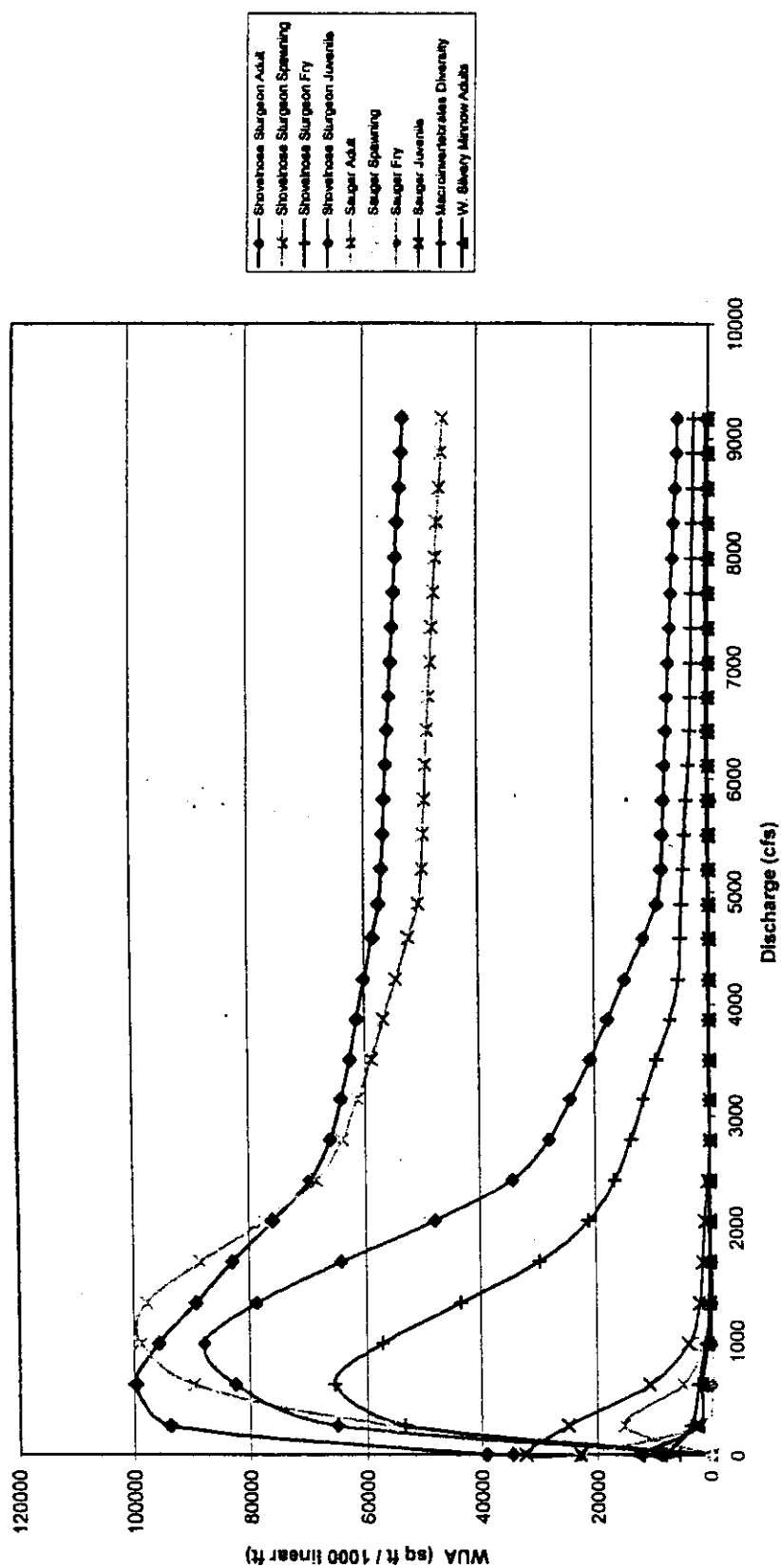


Figure 4. Predicted habitat gain/loss (WUA) as a function of discharge on the Powder River. Discharge is in cubic feet per second (cfs) (where 35.3 cfs = 1 m³/s).

Belle Fourche River -- Species of Concern

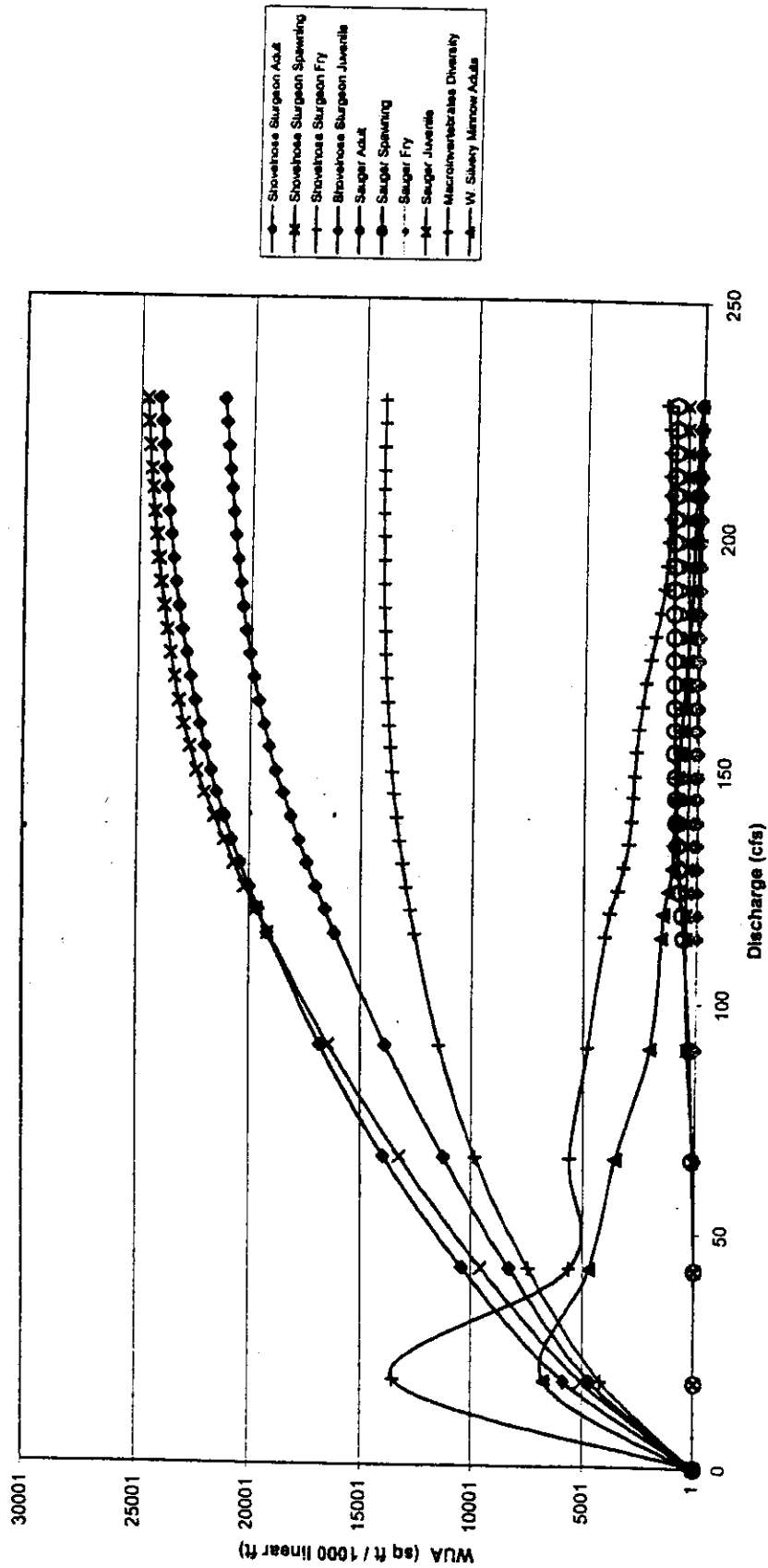


Figure 5. Predicted habitat gain/loss (WUA) as a function of discharge on the Belle Fourche River. Discharge is in cubic feet per second (cfs) (where 35.3 cfs = 1 m³/s).

Crazy Woman Creek - Western Silvery Minnow - 20% Scenario

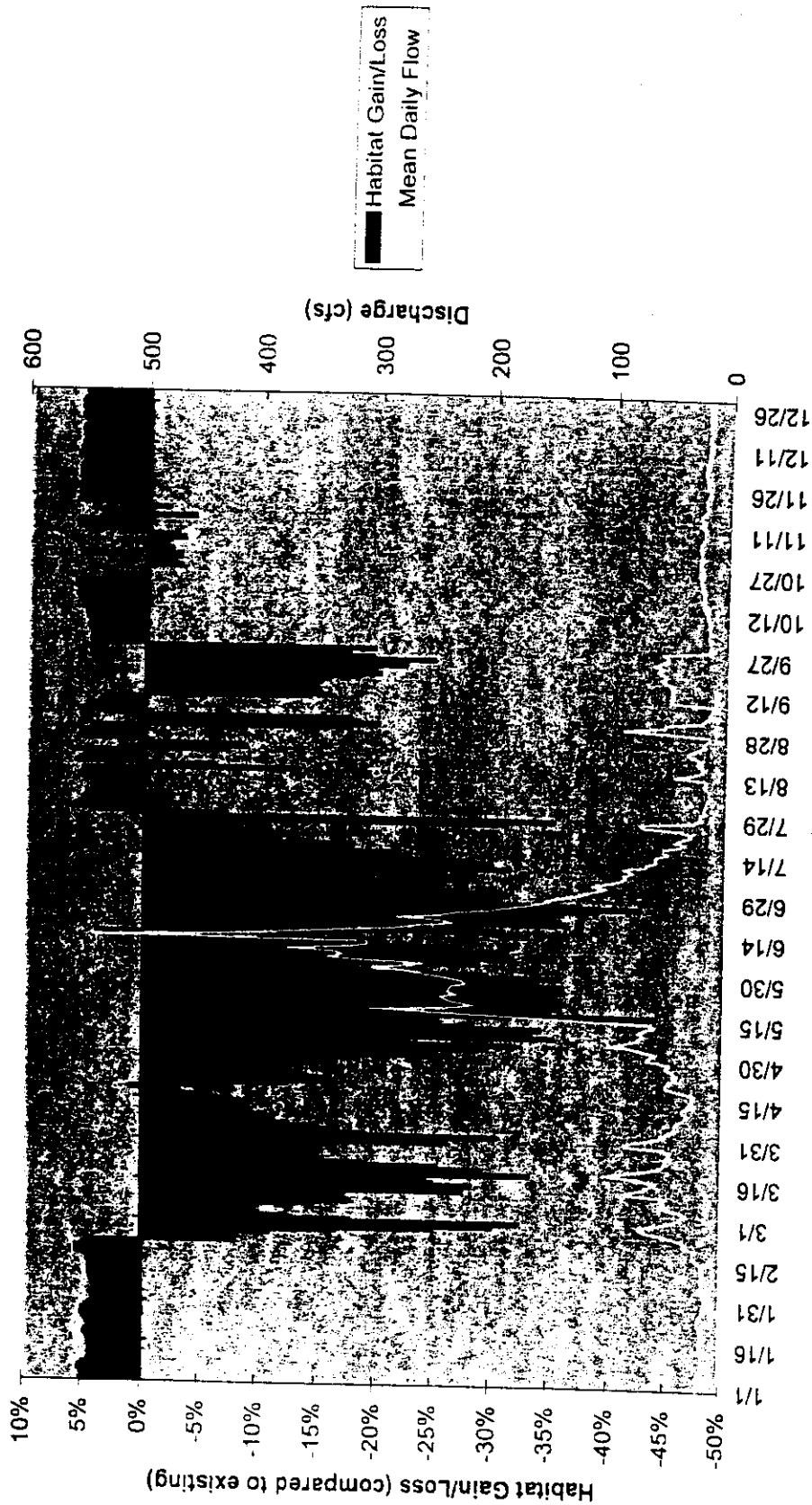


Figure 6. Daily changes in available habitat for Western Silvery Minnow over a typical water year.

Belle Fourche River - Macroinvertebrates - 20% Scenario

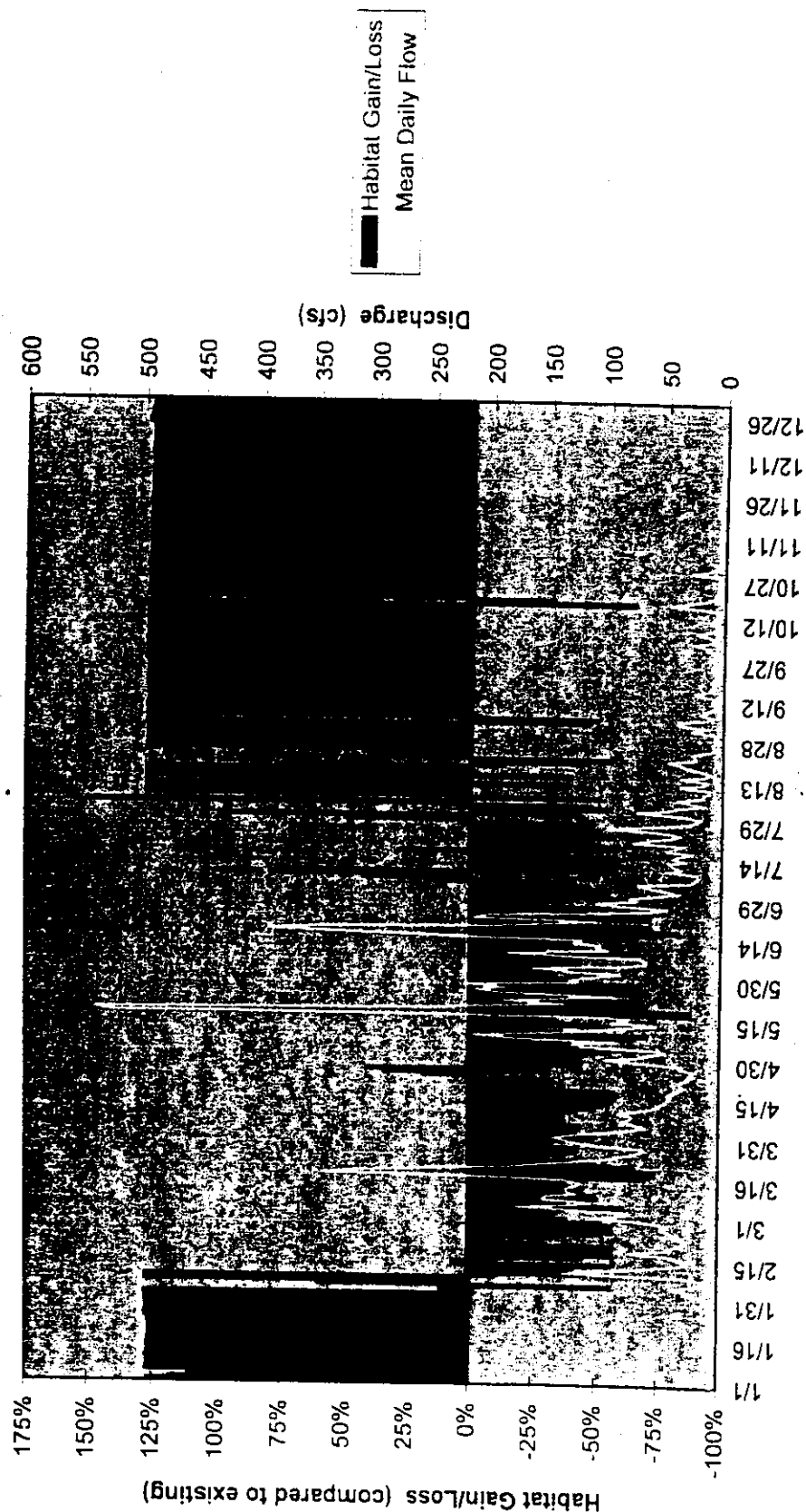
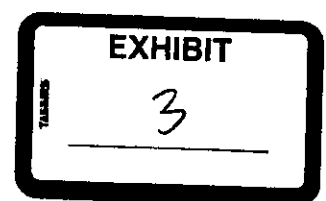


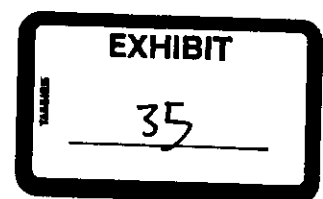
Figure 7. Daily changes in available habitat for benthic macroinvertebrates over a typical water year.



Analysis of Habitat Loss for Target Biota in Rivers Impacted by Long-Term Flow Increases Resulting from CBM Production.

James A. Gore, PhD, Professor and Chair, Dept of Environmental Science and Public Health, Columbus State University, Columbus, GA 31907

A primary concern among ecohydrologists is the potential disruption of the integrity of riverine communities ~~when flows are enhanced by surficial releases~~ resulting from CBM production. Regional hydrogeologists have predicted daily increases in flows of from 20% to 80%. I analyzed the potential impact of flow increases utilizing the Physical Habitat Simulation (PHABSIM) which ties hydrologic information at typical stream reaches with biological information (habitat suitability) to predict changes in the amounts and locations of available habitat over a range of discharges. Continuous habitat loss is considered to be a "bottleneck" in the success of the population or community. Habitat evaluations for several rivers were performed for sauger, shovelnose sturgeon, the endangered western silvery minnow, and benthic macroinvertebrates. Greatest habitat losses, from 40% to 65% for more than 28 consecutive days, were predicted all locations for the western silvery minnow and for macroinvertebrates. It is likely that losses in the richest habitat patches under high flows could be well over 75% during prolonged periods of high flow, especially shallow bypass channels and shoals. Essentially, the loss of habitat creates a mosaic of habitat patches, becoming increasingly small and more isolated from each other. Using numerical models from Haddad and Lande, and assuming limited dispersal for larval fish life stages and for most invertebrates species, the model predicts a decline in secondary production and a concurrent loss of species from higher trophic levels, especially those species which rely directly upon benthic invertebrate production. A reduction or loss of 20 to 30 benthic species, and as many as five fish species, can be predicted for project operation (continuous high flows) of 20 years.



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The State
of Wyoming



Department of Environmental Quality

1043 Coffeen Avenue, Suite D • Sheridan, Wyoming 82801

ITY
3457
4-8050

LAND QUALITY
(307) 672-6488
Fax (307) 672-2213

WATER QUALITY
(307) 672-6457
Fax (307) 674-8060

MEMORANDUM

TO: Brian Bohlmann, NPDES Compliance Program Principal

FROM: Jim Eisenhauer, Compliance Inspector Senior Analyst

SUBJECT: Barlow Complaint: CBM Water Flowing Down Dead Horse Creek

DATE: August 11, 2003

On June 25, 2003, Department of Environmental Quality Inspector, Jim Eisenhauer, met with landowner Eric Barlow to observe produced Coal Bed Methane (CBM) water flowing down Dead Horse Creek. According to Mr. Barlow, water has been continuously flowing down Dead Horse Creek from approximately mid March through the month of June of 2003. The drainage of concern is South Fork Dead Horse Creek which has CBM discharges into reservoirs and off-channel pits within the drainage. The Barlows do not want any of the CBM water flowing onto their property and have been very active in the public comment process to ensure that the CBM water does not enter their property. According to Mr. Barlow, the flows have been fairly continuous since March with increases in flows from time to time. Mr. Barlow is concerned that some of the companies operating upstream may be letting water flow down drainage when the reservoirs fill up, instead of holding all of their water back. The Dead Horse Creek drainage on the Barlow Ranch was examined for flow, as well as the Dead Horse Creek drainage upstream of the Barlow Ranch where a few CBM operators have NPDES discharge permits within the Dead Horse Creek drainage, to determine the source of the water that is currently flowing in the channel.

The South Fork Dead Horse Creek channel was inspected at the southern most end of the Barlow's property in the NE 1/4 NE 1/4 of Section 27, Township 48 North, Range 75 West (Figure 1). Flow was observed in South Fork Dead Horse Creek and continued on down the drainage (Photo #1). The channel was not very defined at this location, and a variety of grasses were present in the area. The second location visited on South Fork Dead Horse Creek was in the NW 1/4 NW 1/4 of Section 22, Township 48 North, Range 75 West (Figure 1). An artesian well is present at this location which provides water for livestock in the area (Photo #2). Water flows into a stock tank at a very low flow rate, and the excess water is piped directly to the

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stream. The discharge pipe from the stock tank was submerged under water in the channel (Photo #3). According to Mr. Barlow, under normal conditions, the pipe would not be submerged, and only a small amount of water would be present in the channel from the stock tank. It would appear that the excess water in the channel is coming from an upstream source, and not from the artesian well at this location. The final location visited was the confluence of South Fork Dead Horse Creek with Middle Fork Dead Horse Creek to form Dead Horse Creek near the Barlow's residence in the NE 1/4 SE 1/4 of Section 16, Township 48 North, Range 75 West. Water was present in South Fork Dead Horse Creek and in Dead Horse Creek, but not in Middle Fork Dead Horse Creek with the exception of some back wash from South Fork Dead Horse Creek at the confluence (Photos #4 and 5). The Middle Fork Dead Horse Creek drainage is approximately the same size as the South fork Dead Horse Creek drainage, but it does not have any, or very little CBM development on it. Therefore, the fact that South Fork Dead Horse Creek has had water flowing in it continuously from mid March through June, and Middle Fork Dead Horse Creek has not had continuous flows except during runoff events, indicates that the source of the flows in South Fork Dead Horse Creek are probably due to other sources than simply runoff and thunderstorm events. Therefore, some of the upstream CBM operators will need to be checked in order to determine if CBM water is being discharged down drainage and resulting in the flows that are reaching the Barlow's property.

source

① On June 25, 2003 at approximately 1411 hours, DEQ inspector Jim Eisenhauer met with Tony Wylie of Yates Petroleum, to observe their CBM discharge points within the South Fork Dead Horse Creek drainage. Yates Petroleum is the first upstream operator within the drainage that has discharges into South Fork Dead Horse Creek. The first permit that was inspected was NPDES permit number WY0037842. This permit was originally issued on November 1, 1998 and contained six outfalls. The permit was then modified on December 6, 2001 and had three of the original six outfalls removed from the permit. Currently outfalls 004, 005, and 006 remain on the permit, and this permit does not restrict the company from discharging into the Dead Horse Creek drainage, even though the company had committed to the total containment of the water in their Permit Modification Application dated November 19, 2001. The modified permit does not restrict the company from discharging into the drainage at any time of the year. Therefore, any discharges under this permit could travel down the Dead Horse Creek drainage, and the company would not be in violation of their permit.

According to Tony Wylie, the wells that discharge under this permit had been shut in for approximately a year to a year and a half due to low gas prices. The wells were turned back on sometime in March, and have continued to discharge. Mr. Wylie stated that the reservoirs would normally have the capacity to hold the water, but the extremely wet spring has caused the reservoirs to fill up with CBM water mixed with runoff water to the point that two reservoirs are overflowing and spilling water out from their outlet works into South Fork Dead Horse Creek. The first outfall that was visited during the inspection was outfall WY0037842-004 which discharges directly into an on-channel reservoir located in the SE 1/4 NW 1/4 of Section 36, Township 48 North, Range 75 West (Figure 1). A discharge was occurring from this facility at the time of the inspection and the water in the reservoir was spilling over into the drainage via a metal corrugated pipe placed at the high water level in the reservoir (Photos #1 and 2). However, water was also observed flowing in the drainage upstream of the outlet works from the

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reservoir (Photo #3). Approximately 1/2 mile upstream of the reservoir which receives discharge water from outfall WY0037842-004 was an abandoned reservoir which no longer receives CBM discharge water under this permit. This reservoir is located in the SE 1/4 SW 1/4 of Section 36, Township 48 North, Range 75 West, and no CBM produced water was observed entering the reservoir or leaving the reservoir via its outlet works (Photo #4). Although the area immediately below the reservoir was damp and it appeared that water may have flowed down the adjacent hill side, no water was observed flowing from the reservoir. The source of the water upstream of the outlet works from the reservoir receiving CBM discharge water from outfall WY0037842-004 may have been from a recent thunderstorm event, but it does not appear to be the result of CBM discharge water.

Outfall WY0037842-005 located in the NE 1/4 NE 1/4 of Section 35, Township 48 North, Range 75 West was visited next, but no water was discharging from this outfall into the drainage (Figure 1). Therefore, this outfall was not contributing to the flows in South Fork Dead Horse Creek (Photo #5).

The final outfall visited under this permit was outfall WY0037842-006 located in the NW 1/4 NW 1/4 of Section 36, Township 48 North, Range 75 West (Figure 1). Water was discharging from this outfall into the reservoir which is located downstream of the reservoir which receives CBM discharge water from outfall WY0037842-004 (Photo #6). Therefore, this reservoir is currently receiving flows from outfalls 004 and 006. Water was discharging from this reservoir via its outlet works into the South Fork Dead Horse Creek drainage (Photos #7 and 8). This is the last discharge point upstream of the Barlow's property and it appears that this permit is the source of the water that is flowing down South Fork Dead Horse Creek. However, according to the permit conditions, the permit does not restrict the company from discharging into the drainage at any time during the year. Therefore, the company does not appear to be in violation of their permit conditions.

Source

Finally, two off-channel reservoirs which receive CBM discharge water from outfalls permitted under NPDES permit number WY0047252 were inspected to make sure that water was not leaking from the reservoirs into the nearby drainage. The first off-channel reservoir inspected was receiving CBM discharge water from outfall WY0047252-007 at the time of the inspection. This reservoir is located in the NE 1/4 SE 1/4 of Section 36, Township 48 North, Range 75 West. The berm surrounding the reservoir as well as the surrounding area was inspected, and no reservoir breaches or seeps were observed from the reservoir. The reservoir is located a considerable distance to the northeast of the South Prong Dead Horse Creek drainage, which reduces the chances of water reaching the channel via the subsurface. The off-channel reservoir which receives CBM discharge water from outfall WY0047252-006 was also visited and this outfall is located in the SE 1/4 NE 1/4 of Section 36, Township 48 North, Range 75W above an unnamed drainage to South Fork Dead Horse Creek. However, no water was being discharged into the reservoir and the reservoir itself was completely empty and in the process of being worked on. Therefore, this outfall is not contributing to any flows in Dead Horse Creek. Outfall 008 was not visited because this outfall has not been constructed at this time. The inspector also visited a reservoir owned by Coleman Oil and Gas Inc. which receives CBM discharge water from outfall WY0041459-004. This reservoir is an on-channel reservoir located in the SW 1/4

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SE 1/4 of Section 31, Township 48 North, Range 74 West (Figure 1). The level of the water in this reservoir was well below the outlet works from the reservoir at the time of the inspection, and was not contributing to the flows in South Fork Dead Horse Creek (Photo #9). This reservoir is located approximately one mile upstream of outfall WY0037842-004 on the same drainage and could contribute to the flows in South Fork Dead Horse Creek if overflows ever occurred.

Based on observations made during the inspection, water is discharging from two reservoirs operated by Yates Petroleum under NPDES permit number WY0037842. The discharges from these reservoirs are resulting in flows in the South Fork Dead Horse Creek drainage and these flows are entering the property owned by the Barlows approximately one to two stream miles to the northwest. However, the permit that is contributing to the flows in South Fork Dead Horse Creek does not restrict the company from discharging into the channel at any time during the year. Therefore, the company is not in violation of their NPDES pennit. However, the permit is due to expire at midnight on October 31, 2003, and there is the possibility that more restrictive conditions may be incorporated into the permit due to downstream landowner's concerns about water flowing down Dead Horse Creek. Therefore, the company may want to consider other options for managing the water in order to keep the water from flowing downstream.

Source

Also, There were some problems observed at the outfalls visited during the inspection that are not in compliance with the conditions specified in the permit. There were no NPDES permit signs present at any of the outfalls visited under NPDES permit numbers WY0037842 and WY0047252 owned and operated by Yates Petroleum. All outfalls need to be identified by an all weather permit sign which conveys the following information: company name, facility name, NPDES permit number, outfall number, legal description, and an emergency contact number. The discharge pipes at outfalls WY0037842-004 and 006 were completely submerged under water and not accessible for sampling purposes. These outfalls need to be brought back to the surface and placed at a location that is above the high water level of the reservoir. The outfalls should also be constructed in such a way that all of the flow leaves the pipe at a single point and a sufficient free fall to the surface should exist for an accurate flow measurement using a calibrated bucket. The free fall will also aid the sampler during sample collection so that a clean, representative grab sample can be collected. The company should apply these conditions to all of their outfalls so that the outfalls can be appropriately identified in the field and accurate flow measurements and clean grab samples can be collected.

SUMMARY:

- 1.) Eric Barlow has voiced concerns about the continuous flow of water down Dead Horse Creek from March through June of 2003. According to Mr. Barlow, the flows have been continuous throughout the specified time period with increases in flows from time to time. Mr. Barlow has been very active in making sure that no CBM water enters their property and is concerned about the recent increase in flows down South Fork Dead Horse Creek.
- 2.) The Barlow Ranch was visited on June 25, 2003 and water was observed flowing down

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POWDER RIVER BASIN

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South Fork Dead Horse Creek. Although a small flow from an artesian well was contributing to the flow, the vast majority of the flow was coming from sources upstream of the Barlow Ranch.

- 3.) No flow was occurring in Middle Fork Dead Horse Creek which has very little if any CBM development within its drainage boundaries. However, South Fork Dead Horse Creek has a substantial amount of CBM development within its drainage, although most of the NPDES permits are for off channel pits which require full containment of the water. However, there are a few option 2 permits that do allow for direct discharge into the drainage under certain conditions.
- 4.) NPDES permit number WY0037842 owned by Yates Petroleum allows for direct discharge into the drainage at any time of the year. This is the first permit that discharges into South Fork Dead Horse Creek upstream of the Barlow Ranch. Wells that operate under this permit had been shut in for approximately a year to a year and a half due to low gas prices. These wells were turned back on around mid March of 2003 which is approximately when flows were first observed by the Barlows on their ranch property.
- 5.) Water was observed leaving two of the reservoirs which receive CBM discharge water from outfalls 004 and 006 under NPDES permit number WY0037842. The water was observed leaving the reservoirs and flowing down South Fork Dead Horse Creek. Although the company has stated in their most recent permit modification application for NPDES permit number WY0037842 that they are committed to the full containment of the water being discharged, there is nothing in the permit that restricts the company from discharging into the drainage at any time during the year.
- 6.) However, NPDES permit number WY0037842 is due to expire at midnight on October 31, 2003, and more stringent permit conditions could be incorporated into the renewed permit. Therefore, the company may want to consider some alternative water management plans in order to prevent excess water from flowing down drainage.
- 7.) Some off-channel pits operated by Yates Petroleum under NPDES permit number WY0047252 were inspected and no reservoir breaches or seeps into the drainage were observed. Also, one on-channel reservoir owned and operated by Coleman Oil and Gas Inc. was observed, but the level of water in the reservoir was well below the outlet works from the reservoir. Outfall 004 under NPDES permit number WY0041459 is the outfall that discharges into this reservoir.
- 8.) Finally, some noncompliance issues were observed during the inspection at outfalls owned and operated by Yates Petroleum. None of the outfalls visited under any permit were identified with an all weather NPDES permit sign. These signs need to be placed in a visible location and convey the following information: The name of the company, the name of the facility, the NPDES permit number, the outfall number, the legal description for the outfall, and an emergency contact number. Also, several of the outfalls were either submerged under the water or buried under the soil which makes collecting a

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POWDER RIVER BASIN

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representative grab sample and an accurate flow measurement nearly impossible. These outfalls need to be brought back to the surface and placed above the high water line so that the outfalls are easily accessible for sampling purposes. The outfalls should be provided with a sufficient free fall to the surface and the flow should be channeled to a single point so that a clean representative grab sample can be collected and an accurate flow measurement can be determined using a calibrated bucket.

James B. Eisenhauer / August 12, 2003

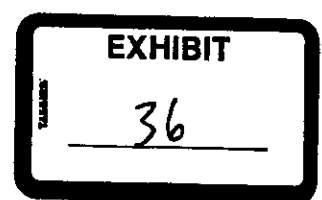
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Senior Analyst

Title

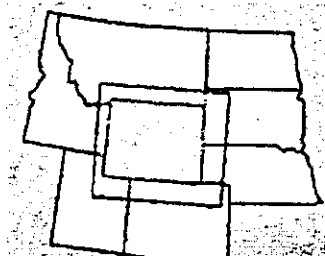
References

National Geographic, 2000, Seamless USGS Topographic Maps, Wyoming. Copyright 2000, National Geographic Holdings, Inc. Topo! For Windows 95, 98, 2000, NT, ME. Discs Number 1 and 4.





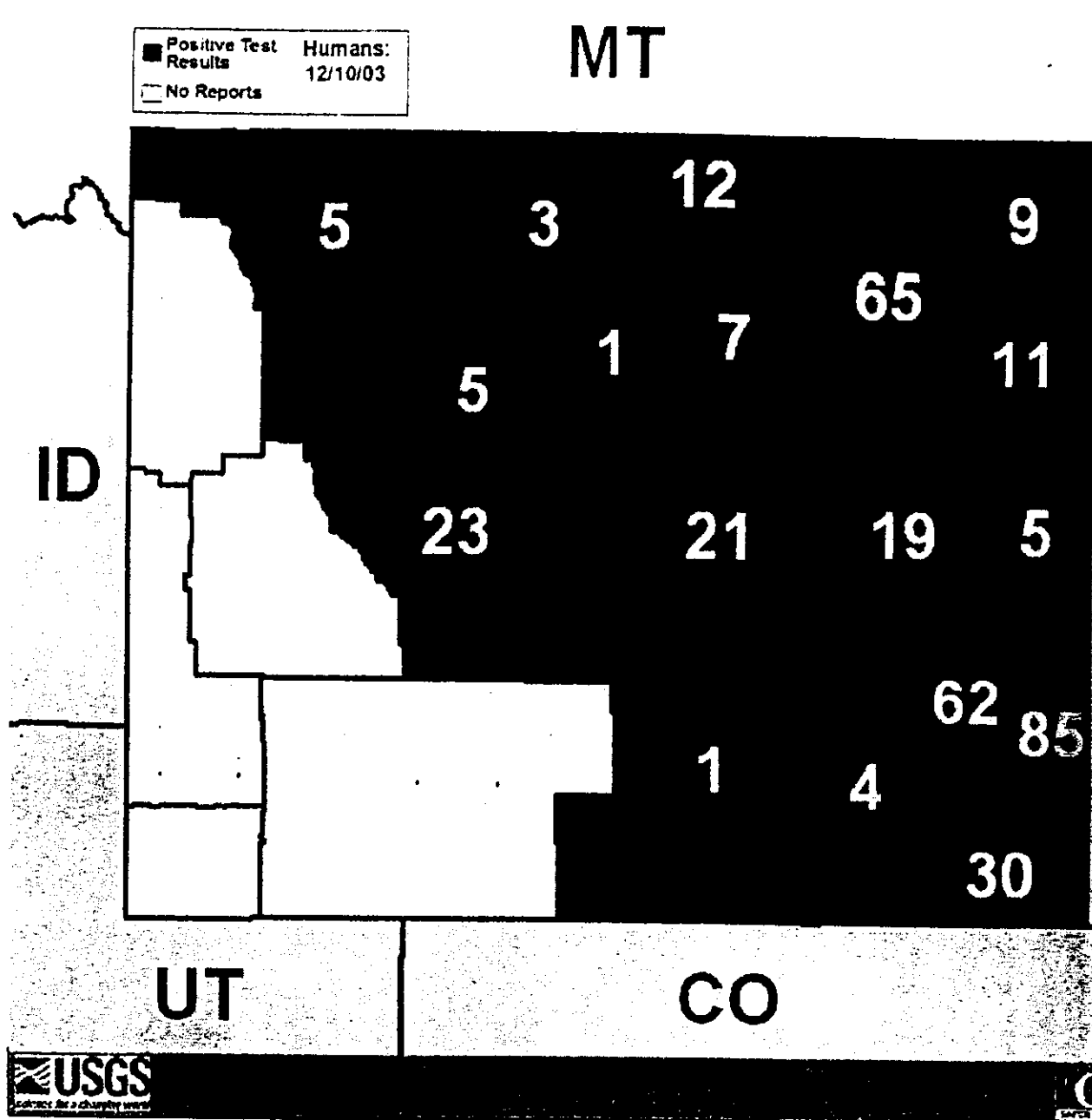
West Nile Virus - Wyoming Cumulative Human Map



These data are based on information voluntarily reported by state health officials to CDC. West Nile Virus (WNV) infection was determined by laboratory testing. Case locations are based on the county of residence (or county equivalent) of the patient, not the medical facility location. Note that the map includes all areas of positive (confirmed or probable) WNV results, but not necessarily all areas with submitted

samples or no reports.

Note: These data are provisional and may be revised or adjusted in the future. CDC only collects data on positive test results for this surveillance category. Additional surveillance data may be available at the state/local level.



Cumulative positive cases:

Albany County	4
Big Horn County	3
Campbell County	65
Carbon County	1
Converse County	19
Crook County	9

Fremont County	23
Goshen County	85
Hot Springs County	5
Johnson County	7
Laramie County	30
Natrona County	21
Niobrara County	5
Park County	5
Platte County	62
Sheridan County	12
Washakie County	1
Weston County	11

Cumulative Report Maps for the year 2003, Wyoming

Cumulative Bird	Cumulative Veterinary	Cumulative Mosquito	Cumulative S
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Links

[Wyoming Department of Health](#)

[Go Back](#) [West Nile Maps Home](#)

For further information or questions, please contact the Centers for Disease Control and Prevention:

(970) 221-6400

email: dvbid@cdc.gov

[U.S. Department of the Interior](#) | [U.S. Geological Survey](#)

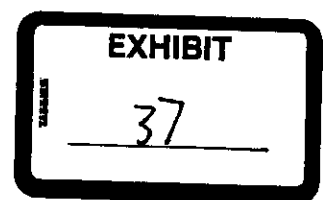
http://westnilemaps.usgs.gov/wyoming/wy_human.html

Contact: [ERG Web Team](#)

Last modification: Wednesday, 10-Dec-2003 09:40:39 EST jf

[USGS Privacy Statement](#) | [Accessibility](#) | [Disclaimer](#)







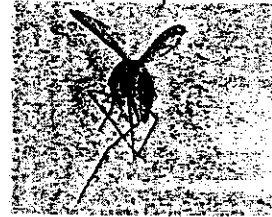
US Army Corps
of Engineers

Regulatory Branch

Information on West Nile Virus

The Relationship Between Birds and Infected Mosquitoes¹

The West Nile Virus is spread to people by the bite of an infected mosquito. The principal transmitter of West Nile Virus is the Northern House Mosquito (*Culex pipiens*). Mosquitoes first become exposed to the virus when they feed on birds that are infected with WNV. Once the mosquito is infected, it may transmit the virus to people or other animals when it bites them. Many birds can be infected with WNV, but crows and blue jays are most likely to die from the infection. Horses, too, are prone to severe WNV infection. People cannot get WNV from another person or horse that has the disease.



(*Culex pipiens*)

Should wetlands be drained to control mosquitoes?

Because the *Culex* mosquito can breed in very small amounts of water, eliminating temporary standing water in plastic containers, discarded tires, or other water-holding containers around one's property can greatly reduce breeding areas. Any stagnant water in rain barrels, irrigation ditches, clogged gutters, backyard home septic systems, and road-side ditches can serve as breeding sites. The difference between these water-holding places and wetlands is the presence of mosquito-eating predators. Wetlands are home to a host of mosquito-eating beetles, backswimmers, water striders, dragonfly larvae, etc. making them significantly less ideal breeding sites for *Culex* mosquitoes.



Culex mosquito laying eggs.

Even after "draining," a wetland may hold water from flooding, rainfall, or snowmelt. These low spots may produce more mosquitoes than healthy wetlands. In addition, filling these wetlands may force water to flow elsewhere, creating flooding or additional wetlands.

Of the forty species of mosquitoes that transmit the virus, three species have been implicated as the most common vectors.² These mosquitoes are rarely found in healthy wetlands. In healthy wetlands water fluctuates regularly, which deters these three virus-carrying mosquitoes

species.

Research from North Dakota found that there were many more mosquitoes in degraded wetlands than in higher quality wetlands.³ The authors conclude that maintaining the natural functions of wetlands (i.e., minimize disturbance) would be a good start to potentially reducing mosquito habitat. The preservation of healthy wetlands, unpolluted by excessive urban storm water runoff and/or sedimentation should therefore be of vital concern to the public and to mosquito control agencies.

¹ Wetlands and West Nile Virus – Ohio State University Fact Sheet West Nile Workgroup
<http://ohioline.osu.edu/wnv-fact/1008.html>

² What Hunters Need to Know about the West Nile Virus - Ducks Unlimited
http://www.ducks.org/news/west_nile_virus_september_2002.asp

³ West Nile Virus Wetlands and Waterways - Oregon Division of State Lands
<http://statelands.dsl.state.or.us/wnv.htm>

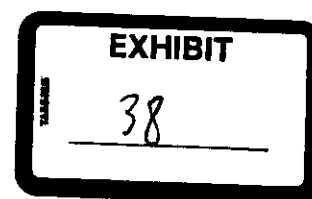
S. Chipps, D. Hubbard, K. Werlin, N. Haugerud, K. Powell. December 2002. Development and Application of Biomonitoring Indicators For Floodplain Wetlands of the Upper Missouri River Basin, North Dakota. South Dakota State University.

Other West Nile Virus Links

[West Nile Virus Basics - Centers for Disease Control and Prevention](#)
[Animal and Plant Health Inspection Service - USDA](#)
[NPIC's West Nile Virus Resource Guide](#)

Home





**BUREAU OF LAND MANAGEMENT
BUFFALO FIELD OFFICE
ENVIRONMENTAL ASSESSMENT (EA)
FOR
Pennaco Energy, Inc.
House Creek 10
PLAN OF DEVELOPMENT
WY-070-03-003**

This site-specific analysis tiers into and incorporates by reference the information and analysis contained in the Powder River Basin Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS), #WY-070-02-065 (approved April 30, 2003), pursuant to 40 CFR 1508.28 and 1502.21. This document is available for review at the Buffalo Field Office. This project EA addresses site-specific resources and/or impacts that are not covered within the PRB FEIS.

Proposed Action Title/Type: Pennaco Energy, INC's House Creek 10 Plan of Development (POD) for 18 APDs.

Proposed Well Information: There are 18 wells proposed within this POD, as follows (*also see well list on last page*):

<u>Name</u>	<u>Number</u>	<u>TWP</u>	<u>RNG</u>	<u>Section</u>	<u>QTR</u>	<u>Lease Number</u>
NISSELIUS FEDERAL	1-6BG	47N	74W	6	NENE	WYW127793
NISSELIUS FEDERAL	1-6WY	47N	74W	6	NENE	WYW127793
NISSELIUS FEDERAL	1-8BG	47N	74W	8	NENE	WYW149963
NISSELIUS FEDERAL	1-8WY	47N	74W	8	NENE	WYW149963
NISSELIUS FEDERAL	11-8BG	47N	74W	8	NESW	WYW149963
NISSELIUS FEDERAL	11-8WY	47N	74W	8	NESW	WYW149963
NISSELIUS FEDERAL	15-8BG	47N	74W	8	SWSE	WYW149963
NISSELIUS FEDERAL	15-8WY	47N	74W	8	SWSE	WYW149963
NISSELIUS FEDERAL	3-8BG	47N	74W	8	NENW	WYW149963
NISSELIUS FEDERAL	3-8WY	47N	74W	8	NENW	WYW149963
NISSELIUS FEDERAL	5-8BG	47N	74W	8	SWNW	WYW149963
NISSELIUS FEDERAL	5-8WY	47N	74W	8	SWNW	WYW149963
NISSELIUS FEDERAL	7-6BG	47N	74W	6	SWNE	WYW143553
NISSELIUS FEDERAL	7-6WY	47N	74W	6	SWNE	WYW143553
NISSELIUS FEDERAL	7-8BG	47N	74W	8	SWNE	WYW149963
NISSELIUS FEDERAL	7-8WY	47N	74W	8	SWNE	WYW149963
NISSELIUS FEDERAL	9-8BG	47N	74W	8	NESE	WYW149963
NISSELIUS FEDERAL	9-8WY	47N	74W	8	NESE	WYW149963

County: Campbell

Applicant: Pennaco Energy, INC

Surface Owners: Nisselius Ranch Company

Conformance with Applicable Land Use Plan and Other Environmental Assessments:

The proposed action is in conformance with the terms and the conditions of the Approved Resource Management Plan for the Public Lands Administered by the Bureau of Land

Black-Footed Ferret:

The black-footed ferret is an endangered species that is closely associated with prairie dogs. A black-footed ferret requires at least 80 acres of black-tailed prairie dog colony for survival. The proposed House Creek 10 project area does not contain any prairie dog colonies and therefore black-footed ferrets are not expected to occur. There would be no effect to black-footed ferrets from the proposed development, and therefore they are not discussed any further in this document.

Bald Eagle:

The U.S. Fish and Wildlife Service lists bald eagles as threatened through out Wyoming. Eagles typically build nests in the crown of large mature trees such as cottonwoods or pines that are close to a reliable prey source. Fish and waterfowl are the primary prey for eagles, however prairie dogs, big game, and livestock carrion may also be part of their diet. Wintering eagles are typically associated with cottonwood galleries or coniferous trees. Although many roosts are near water bodies, upland ponderosa pine stands are also important as they provide thermal cover (Anderson and Patterson, 1988).

The proposed POD area is not suitable habitat for bald eagle nesting or winter roosting. Scattered cottonwoods occur at ponds, residences, and in drainages, however no stands are present (McKee, 2003). The remainder of the proposed POD area contains rolling hills consisting of grasses and sagebrush. A significant water body with a reliable prey base is not present for nesting eagles; the Powder River is approximately 17 miles away and the closest roost on record is approximately 14 miles away. Raptor surveys completed on April 15 and 17, 2003 did not reveal any nesting eagles, or any nest structures that would be indicative of bald eagle activity. There would be no effect to either nesting or roosting bald eagles from proposed development, and therefore they will not be discussed any further in this document.

Ute ladies'-tresses Orchid:

Ute ladies'-tresses orchid are a threatened species that occur primarily on moist, sub-irrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams at elevations between 1,780 and 6,800 feet (BLM, 2003). The orchids are known to occur in Converse County along a tributary of Antelope Creek. The proposed House Creek 10 project area does not have a perennial water source and therefore the orchid is not expected to occur. There is no seed source within the proposed project area and therefore development of the House Creek 10 POD would have no effect on the Ute ladies'-tresses orchid. This species will not be discussed any further in this document.

Canada Lynx:

Canada Lynx is a threatened species that in Wyoming occurs primarily in spruce-fir and lodgepole pine forests with 8-12 degree slopes at elevations between 7,995-9,636 feet (Ruggiero et al., 1999). The proposed House Creek 10 project area does not contain suitable habitat for the Canada Lynx and therefore development would not affect the species. Canada Lynx will not be discussed any further in this document.

WEST NILE VIRUS

West Nile virus (WNV) is a mosquito-borne disease that can cause encephalitis or brain infection. Mosquitoes spread this virus after they feed on infected birds and then bite people, other birds, and animals. WNV is not spread by person-to-person contact, and there is no evidence that people can get the virus by handling infected animals.

Since its discovery in 1999 in New York, WNV has been firmly established in the United States and has continued to spread west. Birds are the natural vector host and serve not only to amplify the virus, but spread it rapidly throughout the country since they are the only known animal to infect mosquitoes. Though less than 1% of mosquitoes are infected with WNV, they still are very effective in transmitting

the virus to humans, horses, and wildlife. The *Culex* genus appears to be the most important mosquito group that vector WNV.

The human health issues related to WNV are well documented and may continue to escalate as the virus moves west. In Wyoming, 392 human cases, with 8 deaths, were attributed to the WNV in 2003. Human cases of WNV in Wyoming occur primarily in the late summer or early fall, although the mosquito season is April through October. There is some evidence that the incidence of WNV tapers off over several years after a peak following initial outbreak (Litzel and Mooney, personal conversations). If this is the case, occurrences in Wyoming are likely to increase over the next few years, followed by a gradual decline in the number of reported cases.

Although most of the attention has been focused on human health issues, WNV has had a significant impact on vertebrate wildlife populations. At a recent conference at the Smithsonian Environmental Research Center, scientists disclosed WNV had been detected in 157 bird species, horses, 16 other mammals, and alligators (Marra et al 2003). In the eastern US, avian populations have incurred very high mortality, particularly crows, jays and related species. Raptor species also appear to be highly susceptible to WNV. As occurrences of WNV increased in the Powder River Basin in 2003, the Wyoming State Vet Lab determined 22 sage-grouse in one study project (90% of the study birds), succumbed to WNV. While birds infected with WNV have many of the same symptoms as infected humans, they appear to be more sensitive to the virus (Rinkes 2003).

Mosquitoes can potentially breed in any standing water that lasts more than 4 days. In the Powder River Basin, there is generally increased surface water availability associated with CBNG development. This increase in potential mosquito breeding habitat provides opportunities for mosquito populations to increase. Preliminary research conducted in the Powder River Basin indicates WNV mosquito vectors were notably more abundant on a developed CBNG site than two similar undeveloped sites (Walker et al. 2003). Reducing the population of mosquitoes, especially species that are apparently involved with bird-to-bird transmission of WNV, such as some *Culex* species, can help to reduce or eliminate the presence of virus in a given geographical area (APHIS 2002). The most important step any property owner can take to control such mosquito populations is to remove all potential man-made sources of standing water in which mosquitoes might breed (APHIS 2002).

The most common pesticide treatment is to place larvicidal briquettes in small standing water pools along drainages or every 100 feet along the shoreline of reservoirs and ponds. It is generally accepted that it is not necessary to place the briquettes in the main water body because wave action prevents this environment from being optimum mosquito breeding habitat. Follow-up treatment of adult mosquitoes with malathion may be needed every 3 to 4 days to control adults following application of larvicide (Mooney, personal conversation). These treatment methods seem to be effective when focused on specific target areas, especially near communities, however they have not been applied over large areas nor have they been used to treat a wide range of potential mosquito breeding habitat such as that associated with CBNG development.

WATER RESOURCES

The project area is within the Dead Horse Creek drainage which is tributary to the Upper Powder River drainage system. Within the POD boundary, all streams are included in the Dead Horse Creek system. Most of the drainages in the area are ephemeral (flowing only in response to a precipitation event or snow melt) to intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source - PRB FEIS Chapter 9 Glossary). The channels are primarily well vegetated grassy swales, without defined bed and bank. The exception to this is found in the channels as they approach the mainstem of Dead Horse Creek. There the channel definition becomes more pronounced with pool and riffle sequences.

ferruginous hawk nests to proposed development, there is potential that raptors may not choose to nest in these locations, or that nesting success may be impacted in future breeding seasons. To help minimize future potential impacts to raptor activities throughout the entire proposed project area, a timing restriction would be required. The timing restriction would state that if construction activities in the proposed House Creek 10 project area were not completed by February 1, 2004 they would stop until new raptor nesting surveys could be completed and potential impacts to raptors in the 2004 breeding and nesting season could be re-analyzed.

If construction of the proposed House Creek 10 POD was not completed by February 1, 2004 and new raptor surveys revealed active raptor nests, an additional protective measure would be required in which no surface disturbing activities would be permitted within ½ mile of active nests during the 2004-breeding season. Short-term disturbances to the proposed House Creek 10 POD would be promptly re-vegetated with seed mixes appropriate for the area. Prompt re-vegetation would minimize the time that important raptor habitat was lost for breeding, nesting, and foraging activities. All new proposed overhead power lines in the proposed project area would be designed to prevent raptor perching.

WEST NILE VIRUS

The PRB FEIS and ROD included a programmatic mitigation measure that states, "The BLM will consult with appropriate state agencies regarding West Nile Virus. If determined to be necessary, a condition of approval will be applied at the time of APD approval to treat mosquitoes for any CBM discharge waters that become stagnant." This project is likely to result in standing surface water which may potentially increase mosquito breeding habitat. BLM has consulted with applicable state agencies, County Weed and Pest and the State Health Department, per above mitigation in the PRB ROD page 18, regarding the disease and the need to treat. BLM has also consulted with the researchers that are continuing to study the dynamics of the spread of the disease and its effects in Wyoming.

There is no evidence that treatment, either through the use of larvicides or malithion, on a site specific or basin-wide scale will have any effect on the overall spread of the disease. The State agencies have not instituted state-wide treatment for mosquitoes due to West Nile Virus, nor are they requiring any mitigation specific to permitting for CBM operations.

Cumulatively, there are many sources of standing water, beyond CBM discharge, throughout the PRB that would add to the potential for mosquito habitat. Sources include; natural flows, livestock watering facilities, coal mining operations, and outdoor water use and features in and around communities.

BLM will keep monitoring this issue by continuing to consult with the State agencies and the researchers working in the area in order to stay abreast of the most current developments and any need to apply mitigation. Based on current information, we determined that no significant impacts in the spread of WNV would occur from the implementation of this project.

WATER RESOURCES

The operator has submitted a comprehensive WMP for this project. It is incorporated-by-reference into this EA pursuant to 40 CFR 1502.21. The WMP incorporates sound water management practices, monitoring of downstream impacts within the Upper Powder River watershed and commitment to comply with Wyoming State water laws and regulations. It also addresses potential impacts to the environment and landowner concerns. Qualified hydrologists, in consultation with the BLM, developed the water management plan. Adherence with the plan, in addition to BLM applied mitigation (in the form of COAs), should minimize project area and downstream potential impacts from proposed water management strategies.

mentioned documents include measures such as burying power lines wherever possible, minimizing road and well pad construction, and the use of disturbance corridors for combining utility lines and access roads. Recommendations for designing reservoirs and wetlands to enhance wildlife habitat are also included in the CBNG Preparation Guidebook. In addition to the following Conditions of Approval, it is recommended that all CBNG wells utilize remote monitoring. The use of remote monitoring would minimize the need to visit well locations, resulting in fewer disturbances to wildlife and their habitat.

Conditions of Approval

A. Site-Specific:

1. Nisselius 7-6-47-74 WY/BG – Drainage crossing leading to the proposed well will be improved with fill or gravel/scoria to provide a safer access to the proposed well location.
2. Nisselius 7-8-47-74 WY/BG – The proposed wells are close to an existing drainage, therefore for environmental concerns, they will be moved southwest away from the drainage and the pits will be lined.
3. If construction in the House Creek 10 POD area is not completed by February 1, 2004 it must be put on hold until a Buffalo WY, BLM biologist is contacted. A member of the Pennaco Marathon Oil Company will need to contact a BLM biologist to determine if additional wildlife surveys are needed and to arrange for the resumption of construction activities.
4. The operator will provide baseline water quality analyses for the permitted water wells located in Section 6 and monitor the water quality on an annual basis. A copy the water analysis results will be submitted to Kathy Brus, NRS or the Authorized Officer in the BLM BFO.
5. To control erosion, no water will be allowed to overflow the tire stock water tanks located near proposed water discharge points.
6. The operator will send a Statement of Compliance with General Permit 98-08 to the US Corps of Engineers detailing the construction of reservoirs within this POD and submit a copy to Kathy Brus, NRS or the Authorized Officer in the BLM BFO. For more information regarding the requirements refer to GP98-08.
7. The head-cut located in the channel of Dead Horse Creek in the NWSW Sec 5, T47N R74W will be closely monitored. If the discharge of water produced in association with the federal minerals increases the erosion rate at that point, the operator will submit a plan to the BLM for approval to mitigate the impact.
8. The operator will be restricted to the maximum discharge rate of 360 gpm from the wells proposed in this action (18 wells). The NEPA analysis and NPDES Permit analysis were both based on the maximum rate of 20 gpm per well. If it is determined that the wells are producing at a rate greater than the approved rate, the operator will restrict production to meet that rate.
9. The operator will comply with all the regulations and reporting requirements of the NPDES permits as issued by the WDEQ for this action. In the event that water quality parameters are not met, water production from all federal wells discharging to these drainages from this POD will be suspended. Production from the wells may only be resumed when the parameters of the permit can be met.